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Abstract

This paper provides estimates and explores the role of own price import demand (Armington) elasticities between different source countries for five agricultural commodities in a framework that incorporates temporal dimension formulated as trading habit persistence. The estimations employ FAO's bilateral food commodity trade database, complemented with importer and exporter country characteristics from other data. The results support the hypothesis that trade patterns are persistent the adjustment following price changes takes effect with delays. Apart from the evidence for the presence of habit persistence and hence different short and long-term elasticities in general, significant differences between countries are also evidenced, in particular between high- and low-income countries and between main geographic areas. Consistently with the barriers for market entry considerations we also observe higher persistence downwards than upwards.

Key words: Armington elasticity, Trade, Habit persistence, Agricultural commodities

JEL classes: E71, F14, O19, Q17

1. Introduction

The imperfect substitution between domestic and foreign goods is well recognised by economists. For example in computable partial and general equilibrium models on trade policy, it is standard practice to assume imperfect substitution between domestic and imported goods. This has typically been represented by Armington elasticities (Armington 1969), which is a measure of the degree of substitution between domestic and imported goods. Existing estimates also consistently suggest higher elasticity of substitution for the long-run than for the short-run (McDaniel & Balistreri 2002). Potential explanations on the imperfect substitution between goods from different origins have gained some attention already since Linder (1961), who suggested that elasticities of substitution be higher between goods from countries with similar income levels, as the consumer tastes, and hence goods produced, in those countries are likely to be similar. Nielsen & Yu (2002) find strong evidence in international rice market that the different varieties of rice typical for different countries are indeed far less than perfect substitutes for one another. More recent discussion has focussed on the role of quality or variety of goods, and firm level, exporter side market access issues in line with Krugman (1980) and Melitz (2003) theories of trade.

While the body of econometric studies on the numeric parameter values of trade substitution elasticities is reasonably large, systematic analysis on underlying causes explaining the elasticity differences in time and between countries has been much scarcer. This paper provides further evidence and estimates on the Armington elasticities for agrifood commodities, and in particular on the relation between the short and long run elasticities. The results also give support to the role of per-capita income behind the observed differences between countries, a line of inquiry suggested by e.g. Markusen (2013). Econometric estimates are produced for FAO's bilateral food commodity trade database, complemented with importer and exporter country characteristics from FAO production data and World Banks World Development Indicators database.

The temporal differences in trade substitution elasticities are addressed by specifying a habit formation type linear expenditure system model, where the share of imports of a commodity from a particular origin is affected by the share of imports in the past. While this formulation can be motivated by evolution of consumer preferences, it can also capture 'trading habits' in more general sense, as noted earlier by Welsch (1989): Observed 'habits' can rise for example from continuity of trade relations due to the international division of labour, long-lasting contracts, long-term trade decisions subsequent to delivery lags, as well as transaction costs and past experiences.

Ordinary Least Squares (OLS) bench mark model, and random and fixed effects Generalised Least Squares (GLS) estimations for several food commodities are run for estimates on habit persistence and own price elasticities, and to evaluate the role of importer or exporter country explanatory factors on both the degree of habit persistence and the own price elasticity. While there are significant differences between commodities studied, the results show strong evidence both for the presence of habit persistence and hence different short and long-term elasticities and for differences between countries. As suggested by Markusen (2013), income level of the importing country is a significant explanatory factor for both habit persistence and price elasticities. Certain major geographic regions also display significantly different estimated coefficients for some of the commodities studied. This may reflect the presence of geography and other bilateral characteristic explanatory factors for trade, as frequently found e.g. by studies using gravity models. Estimation results also suggest that the elasticities for trading costs may be different from those for (FOB) commodity prices.

The next section of this paper reviews the existing Armington elasticity estimates and estimation methods. Section 3 discusses the concept of habit persistence and the subsequent dynamic linear expenditure system that forms the basis for the estimated econometric models. Section 4 describes the data used, and Section 5 some stylised trade characteristics of the commodities studied. Section 6 presents the estimated models and results for Armington elasticities and habit persistence. Section 7 concludes.

2. Trade elasticity estimates

In an exhaustive review of trade elasticities, Hilberry and Hummels (2013) note that in Computable General Equilibrium (CGE) modelling context, the elasticity of substitution typically aims at capturing the long-run demand response to policy change and thereby tend to use higher elasticity estimates than for example some macroeconomic models. In this respect, traditional approaches using time series tend to imply short time horizons that are ill-suited for the study of medium or long-run implications of policy experiments.

Elasticity parameters for the international trade CGE models are typically acquired from econometric estimates, but the justifications for which elasticities to use are not always clear, nor is there any general consensus on the subject. Moreover, these estimates vary greatly, even by an order of magnitude. The traditional way of acquiring trade elasticity estimates relies on reduced form approaches using time series variation in prices, but more recently cross-section trade cost variations or panel data and instrumental variables have been used. A recurrent issue is the difficulty of separating supply and demand parameters: in concentrated markets both importers and exporters have market power and the prices are jointly determined by supply and demand, which raises the issue of identification.

While the body of literature estimating import demand functions is wide and growing, relatively few directly address price elasticity estimates. For example the increasingly popular gravity models of trade tend to focus on non-price correlates of trade, such as distance and similar cultural or socioeconomic characteristics between trading partners. These characteristics are usually not the primary interest in trade policy modelling, but in the context of this paper may explain cross-country differences in addition to the factors identified in Section 6. With regard to direct price effect estimates, Hillberry and Hummels (2013) emphasise three crucial factors explaining the differences:

(1) what parameters are being identified; (2) nature of the price variation used to identify the parameters; and (3) possibly not properly identified parameters.

A particular data related issue with most trade estimation exercises is the measurement error in prices, which can make price elasticity estimates biased towards −1 (Hillberry and Hummels, 2013).[1] International trade statistics, including the ones used in this paper, report trade in (US dollar) values and quantities, and prices are then derived from these values by division. However, the quantity measures are notoriously noisy, with for example a preponderance of quantity=1 observations (Schott 2004). Furthermore, statistical units tend to be thousands of US dollars for values and metric tonnes for quantities, which makes small trade flows inaccurate for estimation purposes.

Aside of estimation issues, different fields of model applications employ significantly different consensus parameter values for import demand elasticities, as discussed by Ruhl (2008). Aggregate import demand in macroeconomic Real Business Cycle models typically has elasticity values between 1 and 2, while trade policy modelling applications use elasticities in the range of 4 to 15. This may be related to the different time horizons in the models and the frequency and the persistence of the modelled shocks, which are central underlying question in this paper.

In this paper we focus on the import substitution between multiple foreign sources. This has an advantage of reducing the role of measurement error and making it possible to address identification issues by controlling or instrumenting for export side effects, as discussed in Hillberry and Hummels (2013). In more recent literature the foreign-foreign substitution has drawn increasing attention also because it allows generating more variation to address the simultaneity problem that is typical to time series estimates. The large number of observations allows omitting observations with small values, which decreases the problem arising from measurement error in prices described above.

The basic functional for the system to be estimated builds on utility functions used in most multi-country, multi-product CGE models. They are typically represented in a triple nested form, where the top tier consists of the utility derived from quantities of K varieties of goods consumed.

$$U = (Q_1, Q_2, \dots, Q_K) \qquad (1)$$

The exact form of the utility function (e.g. Cobb-Douglas, CES, different non-homothetic forms) can vary. The middle tier splits the consumption of each commodity Q within sector k according to source into home (H) and foreign (F). Regularly, this is written in CES form with some additional terms B that represent non-price factors such as tastes, quality and variety, and parameter θ derived from the own price elasticity σ:

[1] This "non-classical measurement error" arises from the appearance of the error e in quantity measure with opposite signs on two sides of the estimated equation, as the price P is acquired form (relatively) accurate measure of reported import value M divided by noisy import quantity $Q{\cdot}e$. Hence, estimating differences from $\ln Q{\cdot}e = \beta \ln (M / Q{\cdot}e) \Leftrightarrow \ln Q + \ln e = \beta \ln p - \beta \ln e$, assuming the time series variation only comes from measurement error, we get $\ln e = \beta(-\ln e) \Leftrightarrow \beta = -1$.

$$Q_k = \left(B_{kH}{Q_{kH}}^{\theta_k^D} + B_{kF}{Q_{kF}}^{\theta_k^D}\right)^{1/\theta_k^D}, \theta_k^D = \left(\sigma_k^D - 1\right)/\sigma_k^D \tag{2}$$

The bottom tier, which is the primary interest in this paper, aggregates the consumption of each imported commodity Q_{kF} from different sources i, again in CES form:

$$Q_{kF} = \left(\sum_i B_{ki}{Q_{ki}}^{\theta_k}\right)^{1/\theta_k}, \theta_k = (\sigma_k - 1)/\sigma_k \tag{3}$$

The source-specific preference weights B in the bottom (and middle) tier are critical for any simulation results and in calibrating observed trade flows. While the preference weights can for example reflect the number, quality or variety of goods in line with Krugman (1980) and Melitz (2003) theories of trade, they are most often still simply taken as deep parameters in the utility function.

The bottom tier import substitution between multiple foreign sources is the main interest of this paper. Possible estimation approaches for the foreign-foreign substitution elasticities include the use of a single cross-section of commodity level bilateral data on tariff and transportation costs data, with exports from all countries into a subset of importers. Bilaterally varying trade costs with fixed export supply characteristics are then used instead of raw prices to identify the price elasticity of demand. This approach is used e.g. by Hummels (2001) and Hertel et al (2007). Romalis (2007) uses a related approach employing changes in relative trading cost changes following the implementation of NAFTA. These studies report significantly higher estimated mean elasticities than the earlier studies with time series. The estimates range from -5.2 to -7.3 depending on the methodology and commodity aggregation.

Feenstra (1994), Broda and Weinstein (2006), and Feenstra et al. (2018), motivated by gains from variety, employ a generalized method of moments (GMM) estimation strategy to correct for the biases implied by the derivation of prices from reported value and quantity data. The most recent of these studies finds median bottom-tier elasticity (referred to as microelasticity) estimates of –4.0 for the US data. Interestingly, the study seems to generally support the widely used rule of thumb that the bottom-tier elasticities are twice as high as the top-tier elasticities (macroelasticity), with the notable exception of food products where the elasticities are equal for both tiers.

Another approach uses instrumental variables in models otherwise similar to time series literature to account for mis-measurement and simultaneity issues. A strong instrument that would be correlated with prices and uncorrelated with error term is, however, not easy to find. In a estimation approach similar to above cross-section studies, Erkel-Rousse and Mirtza (2002) find that instrumenting for prices using wages and exchange rates jump to as high as -7.6, compared to -0.8 acquired from corresponding OLS estimation. We use these insights in dealing with simultaneity, as explained in section 5.

Writing out the total import expenditure E for each imported commodity from sources i we have

$$Q_{ki} = (B_{ki})^{\sigma_k} \left(\frac{p_{ki}}{P_k}\right)^{-\sigma_k} E_k \tag{4}$$

where P_k is the CES price index over imports of k from different sources. Dividing by total import expenditures, this can be written as import shares from each source (for notational convenience we suppress the commodity index k)

$$s_i = (B_i)^{\sigma} \left(\frac{p_i}{P}\right)^{-\sigma} \tag{5}$$

Recent studies with emphasis on firm heterogeneity and monopolistic competition issues re-specify preference weights B to represent e.g. number of firms in each country, and employ variety available in trade data using variations in trade costs and tariffs instead of plain prices. However, as our primary interest in this paper is the difference between the short-term and long-term elasticities, we give the preference weights a different interpretation that ties them to the temporal elasticity variation.

Taking logs of (5) we get

$$\ln s_i = \sigma \ln B_i - \sigma \left(\ln \frac{p_i}{P}\right) \tag{6}$$

It is common in econometric estimations to take preference weights B as exogenous constants, which yields equations that are similar to demand shares in linear expenditure system (LES). Thus, in line with Blanciforti and Green (1983), in a framework of Almost Ideal Demand System (AIDS), the import share of the source i can be presented as

$$\ln s_i = \alpha_i + \sum_j \gamma_j \ln \frac{p_j}{P} \tag{7}$$

where α is a mandatory "base consumption" level below which the consumer gets no utility. In the next Section, we extend this system to a dynamic form with some theoretical background and justifications.

3. Habit persistence and dynamic linear expenditure system

Habit persistence, or 'habit formation' refers to a preference specification where the utility function in the current period depends on the consumption on previous period(s), most commonly formulated as quasi-difference to the immediately preceding period. Under habit persistence, an increase in current consumption lowers the marginal utility of consumption in the current period and increases it in the next period. Intuitively, the more the consumer eats today, the hungrier he wakes up tomorrow. (Schmitt-Grohé & Uribe 2008).

Already Linder (1961) suggested that elasticities of substitution be higher between goods from countries with similar income levels, as the consumer tastes, and hence goods produced, in those countries are likely to be similar. Nielsen & Yu (2002) find strong evidence in international rice market that the different varieties of rice typical for different countries are indeed far less than perfect substitutes for one another. Yang and Koo (1994) have estimated the structure of meat imports in Japan with habit formation.

Not specific to imported goods, but consumption in general Kapteyn et al. (1978) and Kapteyn et al. (1997) find that Dutch consumption data has considerably better fit with a habit stock formed by other people's past consumption. In an experiment by Carbone and Duffy (2014) report overconsumption compared to the optimal path when subjects are given information about other subjects' past consumption choices. Alvarez-Cuadrado et al. (2016) estimate the importance of preference interdependence in services consumption, suggesting that a large fraction of individual's consumption is relative to reference consumption of others and one's own habits, with one third of the weight placed in the consumption of the reference group and another third placed in the agent's past consumption. Campbell and Deaton (1989) attest that excess smoothness to unanticipated income changes and excess sensitivity to anticipated future changes in US consumption data could be explained by a habit formation model. Permanent income is in fact less smooth than measured income.

A common variant of the habit persistence, which is used in the model presented in this paper, is to treat habits as external to the consumer, hence implying that the stock of habit depends on the history of aggregate past consumption as opposed to the consumer's own past consumption. The analysis in this paper builds on already early formulations of the habit formation model, which were cast in the external form, for example in context of a dynamic demand system by Pollak and Wales (1969), the habit formation art of which is discussed in detail in Pollak (1970). A similar though slightly differently formulated non-homothetic utility function is also used in the aforementioned analysis by Markusen (2013).

While the original model builds on consumer tastes and an accordingly specified utility function, it should be noted that the trading habits may also be explained by institutional factors that cannot be directly derived from consumer theory. Differences that remain the same across time for all bilateral trade relations would be captured by fixed effects in estimated models. A study by Welsch (1989) analyses the commodity structure of foreign trade in nine industrialised countries through an expenditure system that allocates total trade expenditures to various commodity groups with prevalent habit persistence assumptions. Welsch notes as potential causes for habit persistence such phenomena as continuity of trade relations among countries due to the international division of labour and long-lasting contracts, long-term trade decisions subsequent to delivery lags as well as transaction costs and past experiences. While the underlying mechanisms for 'institutional habits' may be different, the habit formation expenditure system model is suitable for presenting also these effects. However, this should be kept in mind in eventual welfare analysis – though the issue applies to many import demand analyses that are motivated by particular utility functions: As noted by Hillberry and Hummels (2013), whether the responses implied by some estimated elasticity parameters have anything to do with the original utility parameters is unclear.

Total expenditures on imports of each food commodity are assumed to be allocated to different source countries so as to maximise an objective function that is affine homothetic in the quantities of these imported goods. Thus, the actual demand of commodity from source country i, denoted q_i, depends on a base quantity $\bar{q}_i$, which is independent of price and total expenditure. For the quantities in excess over $\bar{q}_i$, the objective function is homothetic. The consumption decisions over these 'excess quantities' are made within a budget constraint that equals the total expenditure minus the value of the base quantities of all commodities, i.e. $Y - \sum \bar{q}_i$. This setting avoids the implausible unitary expenditure elasticity implied by homothetic utility functions.

Following Pollak and Wales's (1969) example to dynamise the Linear Expenditure System à la Stone, the base quantities $\bar{q}_i$ are not assumed constant, but to follow a habit formation process. More precisely, the base quantities in each period are modelled as linear functions of the actual quantities in the previous period. The optimisation problem of such demand system is fundamentally a dynamic programming question warranting estimation methods such as Arellano-Bond (1991) generalised method of moments. However, we can simplify the problem by composing short-run and long-run utility functions, and approach already suggested by Pollack (1976a, 1976b.) Inserting further structure, let us specify $\bar{q}_{it}$ as a proportion of the lagged observed quantity:

$$\bar{q}_{it} = \lambda_i q_{i,t-1} \,, \tag{8}$$

where $\lambda_i \geq 0$ is a habit formation coefficient. The expenditure allocation problem is then specified as choosing quantities (q_1,...,q_n) to maximise the objective function

$$U = \sum_{k=1}^{n} \beta_k ln(q_{kt} - \lambda_i q_{k,t-1}), \;\; \beta_k \geq 0, \; \sum_{k=1}^{n} \beta_k = 1 \;\; , \tag{9}$$

subject to expenditure constraint

$$\sum_{k=1}^{n} p_{kt} q_{kt} = m_t, \tag{10}$$

where m denotes total expenditure on food imports. The utility function U implies that only the excess over the quantity considered 'normal', specified dynamically in equation (1), yields utility. The equilibrium quantity for demand of good i is thus

$$q_{it}^{*} = \lambda_i q_{i,t-1} + \beta_i (m_t - \sum_{k=1}^{n} p_{kt} \lambda_i q_{k,t-1}) / p_{it} \tag{11}$$

Re-specifying the constant parameter α_i in (7) to reflect persistence in consumption patterns as including the linear relationship to previous consumption levels given in equation (8):

$$\alpha_i = \alpha_i^{*} + \lambda_i q_{i,t-1}. \tag{12}$$

The resulting imports expenditure system to be estimated can then be presented as (for notational convenience, the asterisks from the 'new' alphas are subsequently omitted):

$$s_{it} = \alpha_i + \lambda_i b_{it} + \sum_j \gamma_{ij} \ln \frac{p_j}{p_M}, \tag{13}$$

where $b_{it} = \frac{p_{it}q_{i,t-1}}{m_t}$, which is equal to the share of the expenditure of good from source i that it would have on present period with the present period price but no change in quantity from previous period. This implies that for the length of T periods, price elasticity of imports σ_{iT} can be expressed as

$$\sigma_{ijT} = \gamma_{ij} \frac{1-\lambda_i^T}{1-\lambda_i}, \text{ if } \lambda_i \neq 1. \quad (14)$$

The short-term (one period) elasticity is thus γ_{ij} and long-term elasticity $\gamma_{ij}/(1-\lambda_i)$ if $|\lambda_i|<1$.

As noted earlier, this habit persistence motivated form of the equation does not exclude other interpretations. It can, for example, reflect extensive and intensive margins, and number of trading firms consistent with Melitz theory of trade, which in turn can be regarded part of institutions driven trading habits.

4. Data and commodity trade

Trade data

The primary dataset is the detailed trade matrix provided by the Food and Agriculture Organisation of the United Nations statistics service (FAOSTAT). This panel data includes bilateral trade flows as annual time series for years 1986-2013, more than 400 agricultural and food commodities, 185 reporter countries and 256 partner countries. Import and export flows are recorded as values (1000 USD) and quantities (usually metric tonnes). This allows derivation of commodity and source specific prices for imports though limited by the level of precision that renders price information for very small observations unreliable. In this study, five commodities – rice, wheat, maize, coffee and bananas – are selected for analysis. There are two principal motivations for selecting agricultural commodities: From the economic development point of view, despite the changing emphasis towards services in international trade volumes, primary agriculture products are still important for many developing countries efforts to benefit from global markets. For studying habit persistence, these products have an advantage of being practically homogeneous in time, and also relatively similar across countries which means that actual differences in product characteristics are likely to explain less significant amount of the import substitution elasticities. The three selected cereal commodities are globally the most traded agricultural products whereas coffee and bananas were selected for the particularity of their trading institutions and being primarily produced in developing countries and consumed in high-income countries.

From the data, following variables and their logarithmic transformations were used and/or derived for the estimation of the model (index for commodity has been omitted, as estimations have been conducted separately for each commodity):

$v^{CIF}{}_{ijt}$	value of imports from country i to country j in year t
$q^{IMP}{}_{ijt}$	quantity of imports from country i to country j in year t

v^{FOB}_{ijt} value of exports from country *i* to country *j* in year *t*

q^{EXP}_{ijt} quantity of exports from country *i* to country *j* in year *t*

Tariff data

Ad valorem equivalent tariff data are acquired from Bouët et al (2008), Guimbard et al (2009) and Guimbard et al. (2012) for years 2001, 2004 and 2007 respectively.

τ_{ijt} Ad valorem equivalent import tariff from country *i* to country *j* in year *t*

While these data points do not allow capturing all changes in tariffs over time in the panel used and may thus lead to additional measurement errors, their inclusion is justified to correctly represent the actual shares of each import source in the total imports expenditure. The differences between tariffs levied on imports according to the origin are also significantly more important than the changes over time, since the tariffs have generally developed to the same (mostly decreasing) direction for all countries.

Control and interaction variables

With agricultural commodities, domestic production varies from year to year due to a number of external factors (mostly related to weather conditions), which in turn affects the total exports and imports. Whether this also affects the structure of trade with different partners is not obvious. The hypothesis in the basic expenditure system model assumes that the total imports volume does not affect the partner shares. This hypothesis is controlled against local production data, available in FAOSTAT's "Crops" database, which is directly compatible with the detailed trade matrix data.

The import prices are expressed in CIF (cost, insurance, freight) terms and should therefore include the effects of transport and other logistics costs that may vary between sources.

Two additional data sources used include a compilation of data for Gravity model estimations by CEPII (Mayer & Zinago 2011) incorporating country-specific geographical indicators for 225 countries in the world and variables valid for pairs of countries, and World Bank's World Development Indicators (WDI) data base. CEPII Gravity data include for example the languages spoken in the country under different definitions, a variable indicating whether the country is landlocked, countries' colonial links, bilateral distances for country pairs, and contiguity for each country pair. WDI provide a wide range of socio-economic variables that can be used to characterise each region.

While the available data include a wide range of potential variables characterising the importing and exporting countries, many of those variables are strongly correlated with one another. The selection of included variables has been made so as to minimise multicollinearity problems while maintaining a reasonable number of observations. With this respect, the GDP per capita measure is included as it is available for almost every country and year in the panel, even if it is quite strongly correlated with many other model variables

Derived variables and transformations

From the bilateral trade matrix and tariff data, following variables are derived:

p^{IMP}_{ijt} relative price for imports from country i to country j in year t $\frac{(1+\tau_{ijt})v^{CIF}_{ijt}/q^{IMP}_{ijt}}{\sum_i(1+\tau_{ijt})v^{CIF}_{ijt}/\sum_i q^{IMP}_{ijt}}$

p^{FOB}_{jt} relative price for exports from country i in year t , $\frac{\sum_j v^{EXP}_{ijt}/\sum_j q^{EXP}_{ijt}}{\sum_i\sum_j v^{EXP}_{ijt}/\sum_i\sum_j q^{EXP}_{ijt}}$

m_{jt} total food imports expenditure in country j, calculated as $\sum_i(1+\tau_{ijt})v^{CIF}_{ijt}$

s_{ijt} share of commodity originating from i in total imports expenditure in j, $(1+\tau_{ijt})v^{CIF}_{ijt}/m_t$

b_{ijt} ‘base share’ for commodity demand originating from i imported to j, $p_{ijt}q_{i,t-1}/m_t$

c_{ijt} bilateral “trading characteristics” as $p^{IMP}_{ijt}/p^{FOB}_{it}$.

dummy s^{+}_{ijt} dummy variable with value 1 if s_{ijt} / $(1+\tau_{ijt})$ > $s_{ij,t-1}$ / $(1+\tau_{ij,t-1})$ and 0 otherwise.

Control and interaction variables expressed dollars or kilograms in the original data are transformed into thousands of dollars or tonnes for the convenience of reporting. Similarly, *year* is replaced with a *time* variable with base year 2005 in models that include a trend. As usual in estimating elasticities, logarithmic transformations are used for the relevant variables.

5. Commodities selected for study

Rice

The world trade on rice is dominated by only five exporter countries – Thailand, Viet Nam, India, the USA, and Pakistan – accounting for over 70 percent of the total international rice trade. However, at regional level, some other countries also become important players, occupying very high shares in imports of one or few individual trading partners. Namely in South America, imports from Brazil, Argentina or Uruguay constitute over half of the total rice imports for some neighbouring countries. The share of other South American countries of total rice imports is between 75 and 98 percent in Paraguay, Bolivia, Argentina, Brazil and Chile, and over 50 percent also in Uruguay and Peru. Conversely, rice imports from South America to countries outside the region are below five percent of the total, with the exception of Portugal, Turkey, Switzerland, Senegal, Spain and the Netherlands, where between 9 and 26 percent of rice imports originate from South America. (Muthayya et al. 2014)

To a lesser extent, a regional rice trade pattern can be observed in Europe and some countries in the Eastern Mediterranean, where especially Italy (and in a few cases also Spain and Greece) is an important source of rice imports in many countries. However unlike in South America, all European countries source significant amounts of rice also from outside the region.

This pattern allows aggregating rice exporters into nine regions for the SUR model estimation. Thailand, Viet Nam, India, USA, Pakistan, Italy and China each form a region of their own. Latin American countries are grouped into one exporting region, and all other countries form the last region.

Table 1: Top 10 sources of world rice imports, share of total import value (FAOSTAT bilateral trade data average 2010-2013)

Country	Share
Thailand	25.1 %
Viet Nam	17.4 %
India	12.1 %
United States of America	10.5 %
Pakistan	6.7 %
Italy	4.5 %
China, mainland	3.2 %
Uruguay	2.7 %
Argentina	1.9 %
Brazil	1.7 %

Some of the world's largest rice producers are minor players in international trade of rice. Most notably China, which is with its share of 30% of global rice production by far world's largest producer country, only accounts for 2.4 percent of world trade. Many South-Eastern Asian countries, including Indonesia, Bangladesh, Myanmar and Philippines also feature at the top of producer country list but do not cater for the international market to a noticeable degree.

Table 2: Rice imports from South American countries, share of total import value (FAOSTAT bilateral trade data average 2010-2013)

Importing country	Imports from South America	Importing country	Imports from South America
Paraguay	98 %	Portugal	26 %
Bolivia	95 %	Ecuador	26 %
Argentina	88 %	Turkey	23 %
Brazil	82 %	Switzerland	13 %
Chile	75 %	Senegal	13 %
Uruguay	56 %	Spain	11 %
Peru	49 %	Netherlands	9 %

Wheat

The international wheat market is concentrated to a few players in similar way as rice market. However, for wheat the exports and total production are closely associated, and bilateral trading patterns are not as pronounced as at the rice market. Traditionally, major wheat exporters have been Australia, Canada, the European Union (most notably France and Germany), and the United States.

A recent trend that is not yet fully present in the data base used in this study shows the emergence of Black Sea region – Kazakhstan, Russia, and Ukraine – as a strong player in the global wheat market. While also quality differences play lesser role than at rice market, the recent success of the wheat from the Black Sea region can be partly attributed to lower price.

Table 3: Top 10 sources of world wheat exports, share of total export value (FAOSTAT bilateral trade data average 2010-2013)

Country	**Share**
USA	20.6 %
Canada	12.9 %
France	12.7 %
Australia	12.5 %
Russian Federation	7.7 %
Germany	5.0 %
Argentina	4.0 %
Ukraine	3.4 %
Kazakhstan	2.4 %
India	1.9 %

Maize

The international trade for maize is markedly dominated by the United States, which account for nearly a third of world total exports, reflecting its even greater share of global maize production. Brazil, Argentina and Ukraine each have a share between 10 and 15 per cent of world exports, followed by Russia, European Union and Paraguay with 2 to 3 percent shares. While maize comes in several different varieties, the differences in the bulk of traded commodity are insignificant for quality considerations.

Table 4: Top 10 sources of world maize exports, share of total export value (FAOSTAT bilateral trade data average 2010-2013)

Country	**Share**
USA	31.9 %
Argentina	14.4 %
Brazil	13.1 %
Ukraine	8.0 %
France	7.4 %
Hungary	3.3 %
India	3.2 %
Romania	2.4 %
South Africa	1.8 %
Paraguay	1.3 %

Coffee

For international market considerations, coffee differs from the grains discussed earlier in the important respect that it is primarily produced for exports in all coffee producing countries. It is also interesting from the economic development point of view, as many small producers in developing countries make their living growing coffee. Brazil is by large margin world's biggest coffee producer, followed by Vietnam, Indonesia, Colombia and Ethiopia. The two main coffee species, Arabica and Robusta, have different properties and grow in different conditions. There are distinguishable differences in coffee beans from different regions, owing for growing conditions and different subspecies. Arabica is cultivated in mountainous areas in Latin America, eastern Africa, Arabia, and Asia, while Robusta is grown in western and central Africa, Southeast Asia, and in Brazil.

The international coffee exports patterns reflect the biggest producers, but in addition a significant amount of coffee is processed in third countries (especially Germany, Belgium, the USA and locally Tanzania) and exported again, which is reflected in observed trade flows. This is even more pronounced when the trade with roasted coffee is included.

Table 5: Table 5: Top 10 sources of world coffee exports, share of total export value (FAOSTAT bilateral trade data average 2010-2013)

Country	**Green Coffee**	**Green and Roasted Coffee**
Brazil	26.5 %	19.3 %
Viet Nam	12.0 %	8.8 %
Colombia	9.4 %	6.9 %
Germany	5.8 %	7.9 %
Indonesia	4.8 %	3.5 %
Honduras	4.7 %	3.4 %
Peru	4.7 %	3.4 %
Guatemala	3.9 %	2.8 %
Ethiopia	3.6 %	2.6 %
Belgium	3.1 %	3.7 %
USA	0.0 %	5.7 %
Tanzania	0.2 %	4.0 %

Bananas

Like coffee, bananas are largely produced in developing countries and exported to high income countries. World banana exports are dominated by a handful of countries, mostly in Central and Southern America. Ecuador accounts for a third of world banana exports, and another third is exported from Colombia, Costa Rica and Guatemala with roughly equal share each. At the second place before these three countries is Philippines – the only major banana exporter outside Latin America – with about 17 percent share. However, similar to coffee, large volumes of world banana trade passes through third countries which is reflected in bilateral trade statistics as illustrated by table below.

Table 6: Top 10 sources of world banana exports, share of total export value (FAOSTAT bilateral trade data average 2010-2013)

Country	Share
Ecuador	24.4 %
Belgium	14.3 %
Colombia	8.4 %
Costa Rica	8.2 %
Philippines	6.8 %
Guatemala	5.6 %
United States of America	4.8 %
Germany	3.9 %
Honduras	3.4 %
France	2.4 %

6. Estimation method and results for expenditure systems

This section presents the estimation methods and results for different models. The emphasis in reporting is put on the results from Generalised Least Squares (GLS) with fixed effects models, as this captures bilateral characteristics from the panel data and is also preferred in light of test results. However, since fixed effects may also capture bilateral institutional traits that contribute to the trading habit persistence, the actual coefficients can be significantly higher at least for some countries. Thus, results for corresponding random effects models are also reported for comparison.

Studies that focus on estimating the own-price elasticity typically explain the log of demand difference with the log of the corresponding price difference and control variables. While these estimations tend to have measurement error and simultaneity issues discussed in Section 2, the problems are less critical with the habit persistence formulation employing log levels.

In addition to the models reported in this paper, we have also tried alternative specifications with lags to the price and base quantity variables, instrumental variables as well as seemingly unrelated regression (SUR) for the import demand system. Time series lags and SUR do not significantly affect the coefficients of our primary interest. Adding lags to the base quantity variables seems to confirm the chosen structure for the demand function, as the coefficients for subsequent lags tend to follow the formula for convergent series. However, as the panel is unbalanced these alternative models greatly reduce the number of observations.

Decomposition of bilateral import prices

It is tricky to find valid instruments for the bilateral import (CIF) prices derived from the data. We find that the exporter's FOB price relative to world price, yield of the exported commodity produced in the exporting country, and distance between importer and exporter all are not only correlated with the bilateral CIF price, but have strong explanatory power independent from import prices on the dependent variable and therefore cannot be used as instruments. A possible way forward is to decompose the CIF import prices into destination-generic FOB price and destination specific part that reflects transportation and trading costs. Variation observed in this difference may also capture other factors such as exchange rates, and the 'noise' due to measurement errors and reporting unit issues, because these are likely to be less preponderant in FOB prices aggregated over all destinations. Thus, we derive relative CIF plus tariff prices p^{IMP}, destination-generic FOB prices p^{FOB}, and bilateral "trading characteristics" c from the data volumes v^{IMP} and quantities q^{IMP}, as noted in the previous section.

Variable c incorporates several components that are different in nature and magnitude, and mostly unobservable in available data. Apart from import tariffs, transportation and other bilateral trading costs are included in the measure. However, we cannot reliably match the bilateral export and import values and quantities, because there is a very significant amount of unexplainable inconsistences between reporting countries for same trade flows. Therefore we use the average (FOB) export prices as reported by each exporter for all imports from that origin. This implies that the variable c captures actual differences in selling prices to different destinations that may arise from quality differences in traded products, differences in market powers of sellers and buyers, other contractual arrangements and so forth. Apart from the actual differences, variable c also reflects 'noise' in the data, discussed earlier in section 2.

Estimated models

A total of 51 estimations are documented in this paper. The large number is due to five of the five main models estimated for five different commodities (rice, wheat, maize, bananas, coffee) separately and further in three of the models also for subsamples of high income and other countries for each commodity. Models are estimated with alternative GLS random or fixed effect variants, and the benchmark model also with ordinary least squares. Included variables, commodities, model variants and (sub)samples are summarised in

Table 7. The first four models (I, II, III, IV) are also used as a reference to establish the feasibility of random effects or fixed effects GLS specification and the relevance of possible control variables. The remaining models are estimated as fixed effects GLS. Models II, III and IV are the main interest for individual commodity results, and include direction of change and destination country GDP interaction terms for estimated independent variables. Model V additionally has the main dependent variables estimated separately for different importing regions. Implausibly high or low prices are excluded from estimated samples by omitting observations where the absolute value of natural logarithm of relative import price p^{IMP} is less than 2.

Table 7: Summary of the models estimated

Model	**I**	**II**	**III**	**IV**	**V**
Variables included					
$\ln c$	●	●	●	●	
$\ln c \times dummy\ s^{+}$			●	●	●
$\ln c \times \text{REGION}^{Dest}$					●
$\ln c \times \ln \text{G}DP^{Dest}$				●	●
$\ln p^{FOB}$	●	●	●	●	
$\ln p^{FOB} \times dummy\ s^{+}$			●	●	●
$\ln p^{FOB} \times \text{REGION}^{Dest}$					●
$\ln p^{FOB} \times \ln \text{G}DP^{Dest}$				●	●
$\ln b$	●	●	●	●	
$\ln b \times dummy\ s^{+}$			●	●	●
$\ln b \times \text{REGION}^{Dest}$					●
$\ln b \times \ln \text{G}DP^{Dest}$				●	●
$\ln prod^{Orig}$		●	●	●	●
$\ln yield^{Orig}$		●	●	●	●
Model variants					
Ordinary least squares (OLS)	●				
Random effects (RE)	●	●	●	●	●
Fixed effects (FE)	●	●	●	●	●
Samples estimated					
Whole sample	●	●	●	●	●
High-income importers		●	●	●	
Low and Middle income importers		●	●	●	
Rice	●	●	●	●	●
Wheat	●	●	●	●	●
Maize	●	●	●	●	●
Bananas	●	●	●	●	●
Coffee	●	●	●	●	●

We first estimate a simple model without control variables as OLS (I OLS) and as GLS with random (I RE) or fixed effects (I FE) in form:

$$\ln s_{ijt} = \lambda \ln b_{ijt} + \gamma_1 \ln p_{it}^{FOB} + \gamma_2 \ln c_{ijt} + \epsilon_{ijt} \qquad (18)$$

The OLS benchmark model results show highly significant and intuitively and theoretically feasible estimates for both habit persistence and price elasticity parameters. Coffee and bananas show low short-run price response and conversely high degree of habit persistence. Wheat, in turn, has high price response and relatively low habit persistence. Rice and Maize are in between these extremes. These results are as expected considering the different trade structures and differentiating quality properties of each commodity.

As expected with this type of data, the estimations results (*Annex Table 1*) suggest strong presence of fixed effects, which affect especially coefficients for the base share *b*. Testing with various combinations of country-specific control variables, we find that exporter-specific controls somewhat reduce the fixed effects, but in most cases not as much as to prefer a random effects model. This set of models (II RE, II FE) can be written as:

$$\ln s_{ijt} = \lambda \ln b_{ijt} + \gamma_1 \ln p_{it}^{FOB} + \gamma_2 \ln c_{ijt} + \Phi' F_{it} + \epsilon_{ijt} \tag{19}$$

Where the vectors F include exporting country specific control variables that may explain the imports share and affect the FOB export price. Results are presented in *Annex Table 2*. The most significant controls are (logs of) exporting country production and yield of the traded commodity, both accounting for exogenous variation in supply. Increase in production in exporting country increases also the share of imports, while improvement in yield has a negative effect on the imports share, which follows from the inverse relation between yield and total production, i.e. productivity. Different combinations of control variables, including bilateral characteristics typical to gravity models, were also tried with OLS estimations: For example, the exporter's share is decreased as distance grows and increased with common coloniser and contiguity.

Considering that institutional constrains such as non-tariff trade barriers primarily affect the initial market entry, it is plausible that the Armington elasticities are not symmetric but tend to be higher upwards than downwards. Models III RE and III FE account for this proposition by including interactions with the dummy variable for the direction of the change.

$$\begin{aligned} \ln s_{ijt} = {} & \lambda \ln b_{ijt} + \gamma_1 \ln p_{it}^{FOB} + \gamma_2 \ln c_{ijt} \\ & + \left(\lambda^+ \ln b_{ijt} + \gamma_1^+ \ln p_{it}^{FOB} + \gamma_2^+ \ln c_{ijt}\right) \times dummy\ s_{ijt}^+ + \Phi' F_{it} + \epsilon_{ijt} \end{aligned} \tag{20}$$

Results for these models are presented in *Annex Table 3* and exhibit strong support to the hypothesis that the upward price elasticities are higher than downward ones. The habit persistence, in turn, is stronger downwards, which implies that the asymmetry is largely a matter of adjustment speed. On the long run, the response to price change becomes more symmetric, as discussed more in detail later (see e.g. *Table 9*).

Considering the strong fixed effects and their influence on the estimated coefficients, we include a selection of interaction variables with the main price, cost and habit persistence variables, and also estimate a model with regionally different coefficients. In models IV RE and IV FE interaction terms for trading characteristics, FOB price and base quantities with the destination country GDP per capita are added:

$$\begin{aligned} \ln s_{ijt} = {} & \lambda \ln b_{ijt} + \gamma_1 \ln p_{it}^{FOB} + \gamma_2 \ln c_{ijt} \\ & + \left(\lambda^+ \ln b_{ijt} + \gamma_1^+ \ln p_{it}^{FOB} + \gamma_2^+ \ln c_{ijt}\right) \times dummy\ s_{ijt}^+ \\ & + \left(\theta \ln b_{ijt} + \varphi_1 \ln p_{it}^{FOB} + \varphi_2 \ln c_{ijt}\right) \times GDP_{jt} + \Phi' F_{it} + \epsilon_{ijt} \end{aligned} \tag{21}$$

summarises the results for the fixed effects version of this model (IV FE). Models II FE, III FE and IV FE are also estimated separately for the whole sample, for high-income countries, and for middle and low-income countries. Detailed results for each commodity and country group are given in Annex Tables 4–8.

Table 8: Model IV (FE) with prices, base shares, and GDP per capita interactions – summary

	All importing countries				
Variable	**Rice**	**Wheat**	**Maize**	**Bananas**	**Coffee**
ln c	-0.755***	-0.562**	-0.766***	-0.192	-0.088
ln p^{FOB}	-1.201***	-0.642*	-1.119***	-0.723***	-0.535***
ln b	0.368***	0.450***	0.457***	0.731***	0.750***
ln c × *dummy* s^{+}	-0.155***	0.093	-0.042	-0.067	-0.167***
ln p^{FOB} × *dummy* s^{+}	-0.298***	-0.531***	-0.230***	-0.008	-0.365***
ln b × *dummy* s^{+}	-0.201***	-0.258***	-0.227***	-0.221***	-0.218***
ln c × ln GDP^{Dest}	0.019	-0.118*	0.051	-0.003	-0.003
ln p^{FOB} × ln GDP^{Dest}	0.124**	0.054	0.137**	0.161*	0.115*
ln b × ln GDP^{Dest}	0.063***	0.032***	0.024**	0.027**	0.022***
	High income importing countries				
Variable	**Rice**	**Wheat**	**Maize**	**Bananas**	**Coffee**
ln c	-1.000**	0.034	-0.370	-0.490*	0.180*
ln p^{FOB}	-2.656***	0.030	-0.861*	-1.051*	-0.730***
ln b	0.366***	0.545***	0.499***	0.733***	0.807***
ln c × *dummy* s^{+}	-0.250***	0.031	-0.082*	-0.127*	-0.197***
ln p^{FOB} × *dummy* s^{+}	-0.432***	-0.539***	-0.278***	-0.121	-0.350***
ln b × *dummy* s^{+}	-0.184***	-0.247***	-0.213***	-0.233***	-0.227***
ln c × ln GDP^{Dest}	0.116	-0.291**	-0.070	0.086	-0.086***
ln p^{FOB} × ln GDP^{Dest}	0.566***	-0.150	0.072	0.267*	0.163*
ln b × ln GDP^{Dest}	0.058*	0.004	0.011	0.032*	0.009
	Middle and low income importing countries				
Variable	**Rice**	**Wheat**	**Maize**	**Bananas**	**Coffee**
ln c	-0.683***	-0.784***	-0.796***	-0.137	-0.124
ln p^{FOB}	-1.109***	-0.845**	-1.135***	-0.817**	-0.303
ln b	0.381***	0.433***	0.481***	0.689***	0.697***
ln c × *dummy* s^{+}	-0.113	0.103	-0.097	-0.004	-0.079
ln p^{FOB} × *dummy* s^{+}	-0.072	-0.527*	-0.173	0.159	-0.410***
ln b × *dummy* s^{+}	-0.227***	-0.283***	-0.260***	-0.197***	-0.188***
ln c × ln GDP^{Dest}	-0.131*	-0.121	0.110	0.018	0.031
ln p^{FOB} × ln GDP^{Dest}	-0.129	0.009	0.039	0.245	0.108
ln b × ln GDP^{Dest}	0.068***	0.036*	0.011	0.027	-0.002

legend:
* p<.05; ** p<.01; *** p<.001, standard errors are clustered within each importer-exporter pair.

When estimating models without interaction terms for habit persistence, there is clear evidence for fixed effects also when performing the estimation for different country groups. Significance of fixed effects varies when interaction terms are added, but in the majority of cases, Hausmann test still suggests that fixed effects model be better than a corresponding random effects model. When trying to find a best fitting model, the choice of interaction variables is noticeably different depending on whether a fixed or a random effects specification is chosen. For consistency and comparability, we limit the reporting of individual commodity estimations to the interactions with the per capita GDP of the importing country, which is the most significant of the tried interaction variables and with fixed effects.

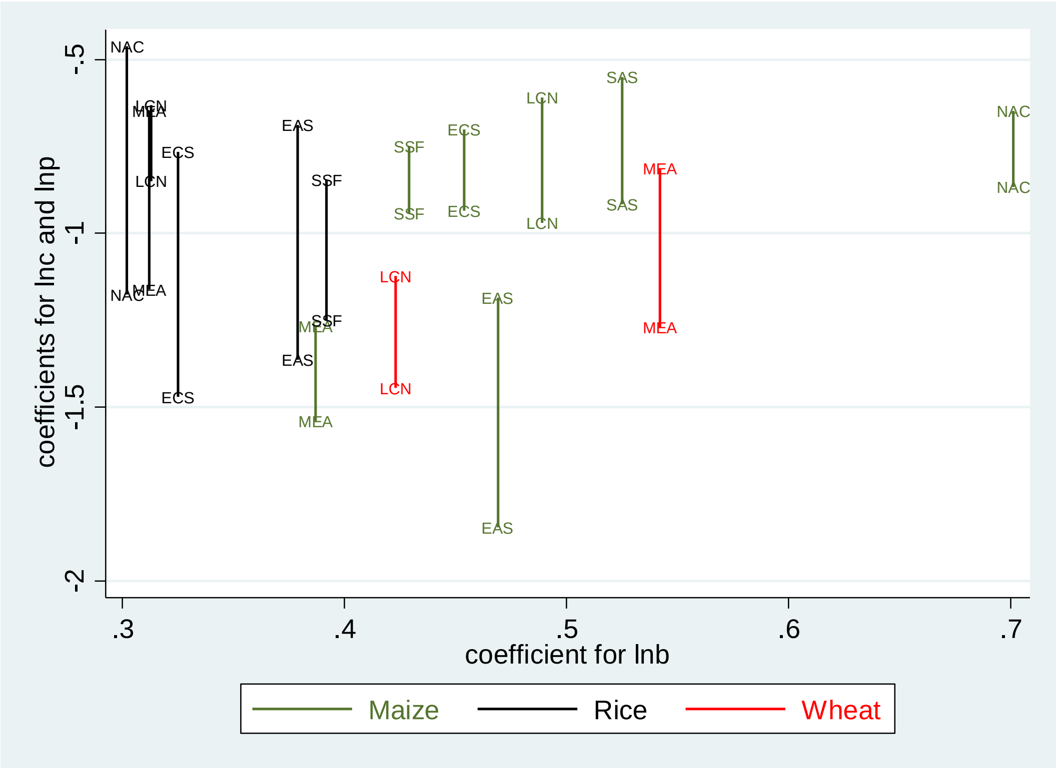
While the results give strong support on choosing the GLS with fixed effects models, it is possible or even likely that some of the bilateral institutional traits that contribute to the trading habit persistence in the broad sense are absorbed by the fixed effects. Thus, choosing the fixed effects specification gives the lower band for the persistence, and the actual coefficients can be significantly higher at least for some countries. Further, as the differences between random effects and fixed effects results are relatively small for price and cost coefficients and conversely large for habit persistence coefficients, we can already suggest that the degree of habit persistence may explain a large part of observed differences in long-term elasticities for different countries. The fixed effects specification also picks up the gravity model type country-pair characteristics and they are not included as control variables.

Model V explores possible regional differences in coefficient values by including region-specific coefficients (subscript R) for price and base quantity variables, using the World Bank major regional groupings (East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East & North Africa, North America, South Asia, Sub-Saharan Africa.) and importing country GDP per capita interaction with the base share:

$$\begin{aligned} \ln s_{ijt} = & \left(\lambda^R \ln b_{ijt} + \gamma_1^R \ln p_{it}^{FOB} + \gamma_2^R \ln c_{ijt}\right) \times R \\ & + \left(\lambda^+ \ln b_{ijt} + \gamma_1^+ \ln p_{it}^{FOB} + \gamma_2^+ \ln c_{ijt}\right) \times dummy\ s_{ijt}^+ \\ & + \left(\theta \ln b_{ijt} + \varphi_1 \ln p_{it}^{FOB} + \varphi_2 \ln c_{ijt}\right) \times GDP_{jt} + \Phi' F_{it} + \epsilon_{ijt} \end{aligned} \tag{22}$$

Results for this model are presented in *Annex Table 5*. There are noticeable differences between the regions especially for price and cost coefficients, even though we have accounted for the income levels by also including the destination country per capita GDP interactions. Coefficients for base quantities appear more similar across regions but vary between commodities. Regional coefficients for FOB price, trading cost, and habit persistence for Rice, Wheat and Maize are illustrated in *Figure 1*. We can also note that for all regions and commodities that have a significant coefficient for both FOB price and trading cost, the latter coefficient is higher than the former, in most cases with a clear margin.

Figure 1: FOB price, trading cost, and habit persistence coefficients, regional



Similarly to the results for Model III FE, we find that the elasticity of demand is consistently significantly smaller for tariffs and import costs than for the export (FOB) price, with the exception of wheat imports to high-income countries. This may be at least partly explained by a greater prevalence of "noise" in the former, since the trading costs are here defined as the difference of source- and destination-specific (CIF) import price and source-generic (FOB) export price. As discussed earlier, bilateral trade data include a large number of small observations and are also more susceptible to recording and reporting errors. The question is, nevertheless, worth further study, as it is possible to form plausible hypotheses explaining the difference. For example, selection of the supplier may not be simultaneous with making of the freight contract, and the price for the latter could be less perceivable than the supply price of the commodity. Institutionally, the sourcing decision for commodities may be largely driven by global wholesale traders, leaving the final purchaser with limited choice. This implies that bilateral trading costs do not factor in to the first stage of purchasing process. A more systematic study of these speculative suggestions, however, falls beyond the scope of this paper.

Estimated coefficients for the cereal grains base quantities range from 0.26 to 0.42 for high-income countries and from 0.17 to 0.30 for low and middle-income countries. Coefficients for bananas and coffee are considerably higher, which is to be expected considering the highly concentrated international wholesale markets for these products. The results for model families I and II also show that the inclusion of fixed effects has a strong reducing effect on the coefficients for base quantities. As the fixed effects is likely to capture some of the variation in bilateral trading patterns also with regard to habits, the actual trading habits persistence may be considerably higher for particular countries or country pairs.

Overall, the estimation results within the group of low and medium-income countries have no significant coefficient for the GDP interaction terms, except for the base quantities of rice that is positive. This suggests that the effect of income induced "ability to be selective" only manifests itself in trading habits above a certain, relatively high threshold value for per capita GDP. Results for high-income countries imply that the destination country GDP has no significant impact on habit persistence but depending on the commodity can increase the elasticity to trading characteristic or decrease the elasticity to the FOB price, thus narrowing the gap between these two elasticities that reflect the response to the total costs of importing. This result may be due to better data quality in higher income reporting countries which is likely to reduce the noise in trading characteristics data discussed earlier. Another possible explanation is that importers in high income countries generally enjoy better access to trading related information and employ sophisticated tools to optimise their costs.*Table 9*, shows estimated short-run and implied long-run elasticities. As the coefficients for base quantities (λ) are somewhat higher in high income countries the differences in implied long-run elasticities ($\gamma/(1-\lambda)$) are smaller. The table reflects the results without the GDP interaction terms (Models II FE and III FE). Similarly, differences between downward and upward changes in import value shares seem very pronounced on the short run but less evident on the long run.

Table 9: Estimated short run coefficients for FOB price and implied long-run elasticities (Model II FE, III FE)

	Model II						**Model III**			
	All countries		*High-income*		*Low and middle-income*		*Downward*		*Upward*	
	γ	σ	γ	σ	γ	σ	γ	σ	γ	σ
Rice	-1.05	-1.61	-0.87	-1.50	-1.32	-1.87	-0.89	-1.72	-1.17	-1.64
Wheat	-0.91	-1.17	-0.73	-0.98	-1.30	-1.56	-0.54	-1.14	-1.06	-1.44
Maize	-1.07	-1.46	-0.94	-1.34	-1.28	-1.67	-0.81	-1.64	-1.04	-1.45
Coffee	-0.42	-0.90	-0.41	-0.95	-0.48	-0.85	-0.22	-1.17	-0.58	-1.43
	λ		λ		λ		λ		λ	
Rice	0.35		0.42		0.30		0.48		0.29	
Wheat	0.23		0.26		0.17		0.53		0.27	
Maize	0.27		0.30		0.23		0.51		0.28	
Coffee	0.54		0.57		0.43		0.81		0.60	

γ short-run elasticity of substitution wrt FOB price, from coefficients for p^{FOB}, p^{FOB} × *dummy* s^+

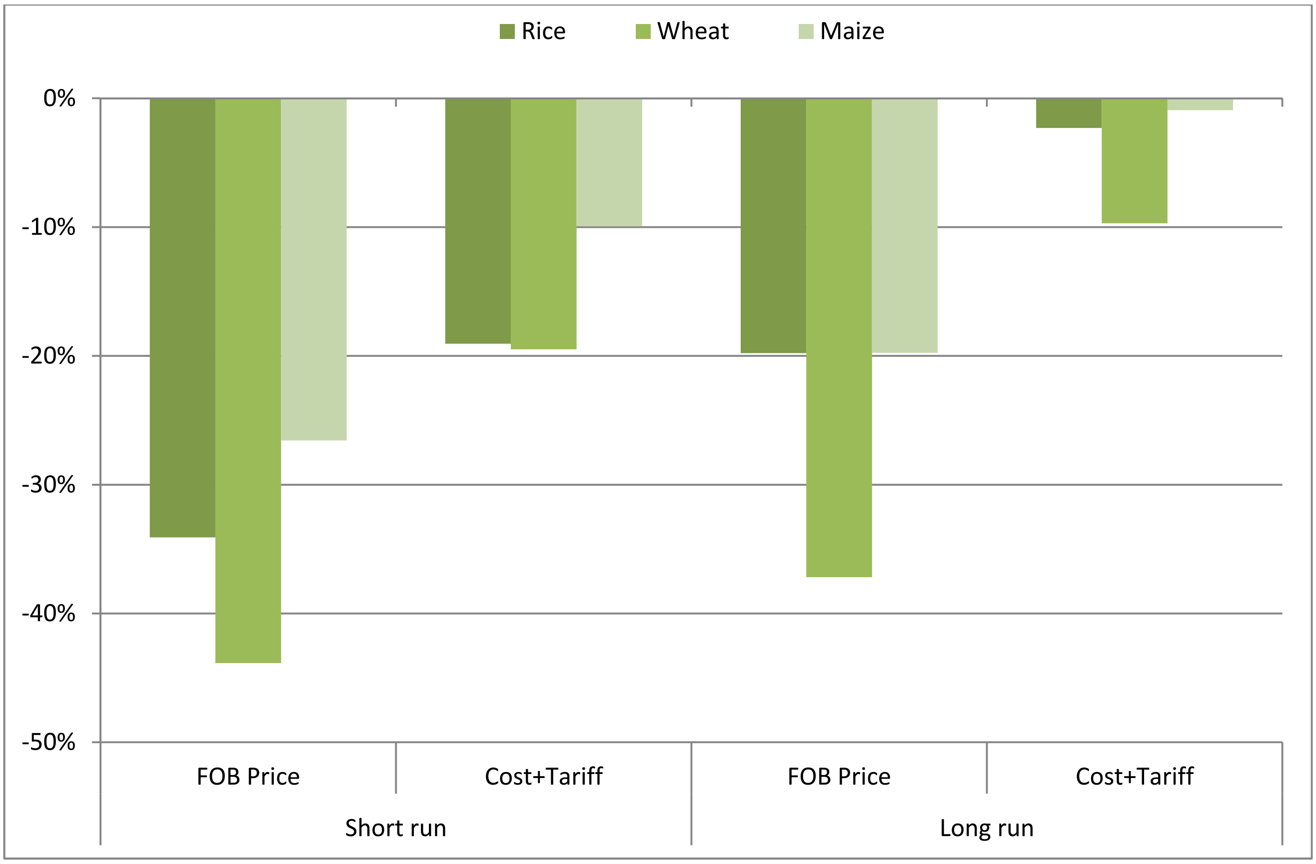
λ habit persistence coefficient, from coefficients for *b*, *b* × *dummy* s^+

σ implied long-run elasticity of substitution wrt FOB price, $\gamma/(1-\lambda)$

Results for bananas are omitted from the table, as most of the coefficients are not significant

The combined effect of higher price elasticities and more persistent trading habits in high income countries compared to rest of the world is illustrated in *Figure 2*, which shows the short and long run elasticities for high income countries relative to other countries as percentage difference. Estimation results indicate that the cereal grains price elasticities are lower in high income countries than in the other countries, except the trading characteristics for wheat. As the trading habits are also more persistent in high-income countries, the differences are somewhat smaller in the long run.

Figure 2: Short and long run Armington elasticity of substitution estimates, %-difference of High Income Countries to other countries



7. Discussion

We have estimated own price import demand elasticities (Armington elasticities) between different source countries for five agricultural commodities in a framework that incorporates temporal dimension formulated as trading habit persistence. Rather than attempting to establish as accurate as possible elasticity estimates as such, our main interest is in differences in coefficient values between different countries and in the implied differences in long and short run elasticities. We find further support to the hypothesis that the trade patterns are persistent and thus the response to changes in relative prices between source countries is not only relatively inelastic but the adjustment also takes effect with considerable delays. Import price elasticities are lower and trading habit persistence is clearly stronger in high-income countries compared to low- and middle-income countries, but there are also regional differences that are not explained by the income levels. Consistently with the barriers for market entry considerations (Melitz theory of trade) we also observe higher persistence downwards than upwards. A somewhat serendipitous result, on an angle not considered in previous studies, indicates that in most cases the elasticity to trading characteristics, i.e. the difference between the bilateral import price including freight, other trading costs and import duties, and the exporting country average FOB export price, is significantly lower than the elasticity to the FOB price.

Short term import price elasticity estimates to price are close to unity for the cereal grains rice, wheat and maize, and under 0.3 for bananas and coffee. The estimated elasticities, and implied longer run elasticities, are lower than most other recent studies have found, even when accounting for the longer time horizons typically considered in those studies, but such low elasticity values are not exceptional commodities in studies focussed on a limited set of agricultural commodities. Short-run elasticities are also in line with earlier studies used for short-term macroeconomic modelling purposes.

While there are differences between commodities studied, the results show strong evidence both for the presence of habit persistence and hence different short and long-term elasticities and for differences between importers. The habit persistence coefficients are typically between 0.2 and 0.8, which implies long-run elasticities that are 1.3 to 5 times the short-term ones, which also seems to fit the parameters acquired earlier for policy modelling applications. We have primarily reported the results for models with bilateral exporter-importer country fixed effects, which yield significantly lower estimates for habit persistence coefficients compared to corresponding random effects models, while the differences in other coefficients are minor. If the characteristics picked up by fixed effects include some actual bilateral habit persistence traits, some of the actual bilateral coefficients would be even higher that the presented estimates.

Habit persistence is consistently higher downwards than upwards, and tends to increase with importing country income level. As the estimated short-term price elasticities are also lower for the same countries, the differences in implied long-run elasticities is narrowed, suggesting that the heterogeneity among importing countries is essentially a matter of different adjustment speeds.

While the significantly smaller coefficients for tariffs and import costs than for the export (FOB) price may be at least partly explained by a greater prevalence of “noise” in the former, the question would be worth a more systematic study. It is not only interesting for explaining the results, but could have policy implications as most traditional trade liberalisation schemes, and applied models evaluating their ex-ante impacts, are mainly concerned with tariffs and trading costs.

The main implication of these results is that it can be more beneficial than without habit persistence effects to an exporter to incur extra costs to enter new markets, since the import demand is clearly persistent downwards. Conversely, existing exporters can exert considerable market power. Stronger persistence observed in imports to high-income countries is likely largely explained by non-tariff trade barriers and other institutional factors that increase costs of market access. This would emphasise the importance of facilitating trade capacities of developing country exporters.

While the results do not dramatically change the long-run implications of trade policy changes, this approach provides a generalised way of modelling international trade with institutional constraints, such as NTMs, which are notoriously challenging to quantify and aggregate from the often only qualitative micro level data. In dynamic applications, this approach may also affect the efficiency of various trade policy measures and incur welfare implications arising from the adjustment paths.

References

Akgul, Z., Villoria, N.B., Hertel, T., 2015. Theoretically-Consistent Parameterization of a Multi-sector Global Model with Heterogeneous Firms, in: Presented at the 18th Annual Conference on Global Economic Analysis, Melbourne, Australia.

Akgul, Z., Villoria, N.B., Hertel, T.W., 2016. GTAP-HET: Introducing Firm Heterogeneity into the GTAP Model. Journal of Global Economic Analysis 1, 111–180. https://doi.org/10.21642/JGEA.010102AF

Alvarez-Cuadrado, F., Casado, J.M., Labeaga, J.M., 2016. Envy and Habits: Panel Data Estimates of Interdependent Preferences. Oxf Bull Econ Stat 78, 443–469. doi:10.1111/obes.12111

Armington, P.S. (1969). A theory of demand for products distinguished by place of production. *IMF Staff Papers 16*, pp. 159–176.

Arellano, M., Bond, S., 1991. Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. Rev Econ Stud 58, 277–297. https://doi.org/10.2307/2297968

Atkin, D., 2013. Trade, Tastes, and Nutrition in India. The American Economic Review 103, 1629–1663.

Blanciforti L, and R Green (1983). An Almost Ideal Demand System Incorporating Habits: An Analysis of Expenditures on Food and Aggregate Commodity Groups. *The Review of Economics and Statistics*, Vol. 65:3, pp. 511-515

Blonigen, B.A., Wilson, W.W., 1999. Explaining Armington: what determines substitutability between home and foreign goods? Canadian Journal of Economics 1–21.

Boonsaeng, T., 2006. Three essays on the demand of imported and domestic meat and livestock in the United States.

Bouët, A., Decreux, Y., Fontagné, L., Jean, S., Laborde, D., 2008. Assessing applied protection across the world. Review of International Economics 16, 850–863.

Broda, C., Weinstein, D.E., 2006. Globalization and the Gains from Variety. The Quarterly Journal of Economics 121, 541–585.

Campbell, J., Deaton, A., 1989. Why is Consumption So Smooth? Rev Econ Stud 56, 357–373. doi:10.2307/2297552

Carbone, E., Duffy, J., 2014. Lifecycle consumption plans, social learning and external habits: Experimental evidence. Journal of Economic Behavior & Organization 106, 413–427.

Carrasco, R., Labeaga, J.M., David López-Salido, J., 2005. Consumption and Habits: Evidence from Panel Data*. The Economic Journal 115, 144–165. doi:10.1111/j.1468-0297.2004.00963.x

Chen, P.Y., Veeman, M.M., 1991. An Almost Ideal Demand System Analysis for Meats with Habit Formation and Structural Change. Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie 39, 223–235. doi:10.1111/j.1744-7976.1991.tb03569.x

Duesenberry, J.S., 1949. Income, saving, and the theory of consumer behavior. Harvard University Press.

Dynan, K.E., 2000. Habit Formation in Consumer Preferences: Evidence from Panel Data. The American Economic Review 90, 391–406.

Feenstra, R.C., 1994. New Product Varieties and the Measurement of International Prices. American Economic Review 84, 157–177.

Feenstra, R.C., Luck, P., Obstfeld, M., Russ, K.N, 2018. In Search of Armington Elasticity. The Review of Economics and Statistics 100, 135–150.

Gallaway, M.P., McDaniel, C.A., Rivera, S.A., 2003. Short-run and long-run industry-level estimates of US Armington elasticities. The North American Journal of Economics and Finance 14, 49–68.

Gibson, K., 2003. Armington elasticities for South Africa: Long-and short-run industry level estimates. TIPS Working Paper 12.

Guariglia, A., Rossi, M., 2002. Consumption, habit formation, and precautionary saving: evidence from the British Household Panel Survey. Oxf Econ Pap 54, 1–19. doi:10.1093/oep/54.1.1

Guimbard, H., Jean, S., Mimouni, M., Pichot, X., 2012. MAcMap-HS6 2007, an exhaustive and consistent measure of applied protection in 2007. International Economics 130, 99–121.

Guimbard, H., Laborde, D., Mitaritonna, C., 2009. A picture of tariff protection across the world in 2004: MAcMap-HS6, version 2 (No. 2009–22), CEPII Working Paper. CEPII.

Heien, D., Durham, C., 1991. A Test of the Habit Formation Hypothesis Using Household Data. The Review of Economics and Statistics 73, 189–199. doi:10.2307/2109508

Hillberry, R., Hummels, D., 2013. Trade Elasticity Parameters for a Computable General Equilibrium Model, in: Peter B. Dixon and Dale W. Jorgenson (Ed.), Handbook of Computable General Equilibrium Modeling. Elsevier, pp. 1213–1269. https://doi.org/10.1016/B978-0-444-59568-3.00018-3

Hillberry, R.H., Anderson, M.A., Balistreri, E.J., Fox, A.K., 2005. Taste parameters as model residuals: assessing the "fit" of an Armington trade model. Review of International Economics 13, 973–984.

Holt, M.T., Goodwin, B.K., 1997. Generalized habit formation in an Inverse Almost Ideal Demand System: An application to meat expenditures in the U.S. Empirical Economics 22, 293–320. doi:10.1007/BF01205360

Houthakker, H.S., Taylor, L.D., 1966. Consumer demand in the United States: 1929-1970: analyses and projections. Harvard University Press.

Kapteyn, A., Van de Geer, S., Van de Stadt, H., Wansbeek, T., 1997. Interdependent Preferences: An Econometric Analysis. Journal of Applied Econometrics 12, 665–686.

Kehoe, T.J., Pujolas, P.S., Rossbach, J., 2016. Quantitative Trade Models: Developments and Challenges (SSRN Scholarly Paper No. ID 2846943). Social Science Research Network, Rochester, NY.

Linder S.B. (1961). *An Essay on Trade and Transformation*. New York: John Wiley.

Manser, M.E., 1976. Elasticities of Demand for Food: An Analysis Using Non-Additive Utility Functions Allowing for Habit Formation. Southern Economic Journal 43, 879–891. doi:10.2307/1056349

Markusen, J.R., 2013. Putting per-capita income back into trade theory. *Journal of International Economics 90*, 255–265. https://doi.org/10.1016/j.jinteco.2013.04.003

McDaniel, C.A., Balistreri, E.J., 2003. A discussion on Armington trade substitution elasticities. EconWPA.

Meghir, C., Weber, G., 1996. Intertemporal Nonseparability or Borrowing Restrictions? A Disaggregate Analysis using a U.S. Consumption Panel. Econometrica 64, 1151–1181. doi:10.2307/2171960

Muthayya, S., Sugimoto, J., Montgomery, S. and F. Maberly, G. (2014). An overview of global rice production, supply, trade, and consumption. *Annals of the New York Academy of Sciences*. 1324. 10.1111/nyas.12540.

Naik, N.Y., Moore, M.J., 1996. Habit Formation and Intertemporal Substitution in Individual Food Consumption. The Review of Economics and Statistics 78, 321–328. doi:10.2307/2109934

Nielsen C.P. and W. Yu (2002). Integration of the International Rice Market: Implications for Trade Liberalization.

Oyamada, K., 2017. Behavioral Characteristics of Applied General Equilibrium Models with Variable Elasticity of Substitution between Varieties from Different Sources. Presented at the 20th Annual Conference on Global Economic Analysis, West Lafayette, IN, USA.

Pollak, R.A. (1970). Habit formation and Dynamic Demand Functions. *The Journal of Political Economy*, Vol. 78:4.1, pp. 745–763

Pollak, R.A. and T.J. Wales (1969). Estimation of the Linear Expenditure System. *Econometrica*, Vol. 37:4.1, pp. 611–628

Pollak, R.A., 1976a. Habit formation and long-run utility functions. Journal of Economic Theory 13, 272–297.

Pollak, R.A., 1976b. Interdependent preferences. The American Economic Review 66, 309–320.

Ruhl, K.J., 2008. The International Elasticity Puzzle (No. 08-30), Working Papers. New York University, Leonard N. Stern School of Business, Department of Economics.

Schott, P.K., 2004. Across-Product Versus Within-Product Specialization in International Trade. Q J Econ 119, 647–678. https://doi.org/10.1162/0033553041382201

Saito, M. (2004). Armington elasticities in intermediate inputs trade: a problem in using multilateral trade data. *Canadian Journal of Economics*, Vol 37:4, pp 1097–1117.

Schmitt-Grohé S., Uribe M. (2008) Habit Persistence. In: Palgrave Macmillan (eds) The New Palgrave Dictionary of Economics. Palgrave Macmillan, London

Valente, S., 2009. International status seeking, trade, and growth leadership. Canadian Journal of Economics/Revue canadienne d'économique 42, 554–589.

Welsch, H. (1989). Habit persistence and Structure of International Commodity Trade, A Demand System Analysis for Nine Industrialized Countries. *Empirical Economics*, Vol. 14, pp. 21-42.

Yang, S.-R., Koo, W.W., 1994. Japanese Meat Import Demand Estimation with the Source Differentiated AIDS Model. Journal of Agricultural & Resource Economics 19.

Appendix 1: Annex tables

Annex Table 1: Models I OLS, I RE, I FE (OLS, random effects, fixed effects)

OLS models

	Rice	Wheat	Maize	Bananas	Coffee
ln *c*	-0.589***	-0.196***	-0.470***	-0.221***	-0.281***
ln p^{FOB}	-0.785***	-0.606***	-0.752***	-0.261***	-0.168***
ln *b*	0.897***	0.937***	0.881***	0.964***	0.916***
N	24683	9676	10499	8286	19697
R^2	0.922	0.899	0.916	0.957	0.974
Root MSE	1.522	1.762	1.843	1.314	1.089
F	96833.246	28827.934	38207.012	61389.756	2.47E+05

Random effects models

	Rice	Wheat	Maize	Bananas	Coffee
ln *c*	-0.741***	-0.849***	-0.669***	-0.250***	-0.236***
ln p^{FOB}	-0.994***	-1.332***	-1.082***	-0.382***	-0.273***
ln *b*	0.603***	0.502***	0.456***	0.799***	0.738***
N	24683	9676	10499	8286	19697
N_{groups}	3056	1246	1425	995	2139
σ	1.392	1.607	1.671	1.244	1.055
σ_u	0.637	0.959	0.969	0.437	0.443
σ_e	1.238	1.289	1.361	1.164	0.957
ρ	0.209	0.356	0.337	0.124	0.176
R^2_{within}	0.195	0.097	0.164	0.305	0.273
$R^2_{overall}$	0.723	0.662	0.623	0.798	0.794
$R^2_{between}$	0.843	0.783	0.728	0.917	0.902
χ^2	11304.414	2022.015	2580.911	9083.013	11848.953
Root MSE	1.334	1.429	1.462	1.233	1.010

Fixed effects models

	Rice	Wheat	Maize	Bananas	Coffee
ln *c*	-0.686***	-0.996***	-0.705***	-0.256***	-0.183***
ln p^{FOB}	-0.893***	-0.976***	-1.014***	-0.238*	-0.360***
ln *b*	0.361***	0.231***	0.272***	0.542***	0.501***
N	24683	9676	10499	8286	19697
N_{groups}	3056	1246	1425	995	2139
σ	2.116	2.778	2.487	1.831	1.534
σ_u	1.716	2.461	2.081	1.414	1.199
σ_e	1.238	1.289	1.361	1.164	0.957
ρ	0.658	0.785	0.701	0.596	0.611
R^2_{within}	0.200	0.118	0.177	0.306	0.274
$R^2_{overall}$	0.701	0.475	0.548	0.795	0.789
$R^2_{between}$	0.806	0.582	0.631	0.911	0.892
Root MSE	1.158	1.204	1.265	1.092	0.904
F	560.996	111.526	168.241	311.805	541.328
$corr(u_i,X_b)$	0.739	0.534	0.538	0.808	0.814

Legend

* p<.05; ** p<.01; *** p<.001, standard errors are clustered within each importer-exporter pair

Annex Table 2: Models II RE, II FE (random effects, fixed effects)

Random effects models

	Rice	Wheat	Maize	Bananas	Coffee
ln *c*	-0.795***	-0.896***	-0.675***	-0.218***	-0.208***
ln p^{FOB}	-1.037***	-1.048***	-0.957***	-0.365***	-0.232***
ln *b*	0.586***	0.468***	0.439***	0.789***	0.706***
ln $prod^{Orig}$	0.081***	0.331***	0.189***	0.047**	0.176***
ln $yield^{Orig}$	-0.162***	-0.252***	0.108	0.204***	0.119***
N	19203	9616	10045	6003	15405
N_{groups}	2229	1227	1372	728	1536
σ	1.386	1.602	1.660	1.215	1.001
σ_u	0.607	0.960	0.961	0.494	0.452
σ_e	1.246	1.283	1.353	1.110	0.893
ρ	0.192	0.359	0.335	0.165	0.204
R^2_{within}	0.197	0.104	0.166	0.311	0.327
$R^2_{overall}$	0.709	0.660	0.615	0.821	0.812
$R^2_{between}$	0.841	0.733	0.707	0.917	0.899
χ^2	9065.942	2337.698	2781.442	7287.164	12042.533
Root MSE	1.348	1.408	1.446	1.163	0.921

Fixed effects models

	Rice	Wheat	Maize	Bananas	Coffee
ln *c*	-0.785***	-0.995***	-0.698***	-0.205***	-0.117**
ln p^{FOB}	-1.052***	-0.908***	-1.067***	-0.188	-0.417***
ln $prod^{Orig}$	0.218***	0.927***	0.470***	0.101	0.268***
ln $yield^{Orig}$	-0.445***	-0.616**	-0.442**	0.132	0.070
ln *b*	0.347***	0.227***	0.267***	0.553***	0.535***
N	19203	9616	10045	6003	15405
N_{groups}	2229	1227	1372	728	1536
σ	2.106	2.803	2.483	1.757	1.348
σ_u	1.698	2.492	2.081	1.362	1.009
σ_e	1.246	1.283	1.353	1.110	0.893
ρ	0.650	0.790	0.703	0.601	0.561
R^2_{within}	0.205	0.127	0.181	0.311	0.330
$R^2_{overall}$	0.597	0.405	0.445	0.813	0.784
$R^2_{between}$	0.687	0.371	0.473	0.904	0.848
Root MSE	1.171	1.199	1.257	1.041	0.848
F	275.690	73.096	102.364	163.061	336.350
corr(u_i,X_b)	0.469	-0.041	0.059	0.785	0.615

Legend
* p<.05; ** p<.01; *** p<.001, standard errors are clustered within each importer-exporter pair.

Annex Table 3: Models III RE, III FE (random effects, fixed effects)

Random effects models

	Rice	Wheat	Maize	Bananas	Coffee
ln *c*	-0.717***	-0.755***	-0.587***	-0.145***	-0.121***
ln p^{FOB}	-0.872***	-0.477***	-0.652***	-0.258***	-0.020
ln *b*	0.674***	0.773***	0.679***	0.980***	0.918***
ln *c* × *dummy* s^{+}	-0.186***	0.098	-0.067	-0.095	-0.166***
ln p^{FOB} × *dummy* s^{+}	-0.329***	-0.688***	-0.279***	-0.073	-0.415***
ln *b* × *dummy* s^{+}	-0.218***	-0.312***	-0.259***	-0.243***	-0.228***
ln $prod^{Orig}$	0.067***	0.221***	0.150***	0.030**	0.117***
ln $yield^{Orig}$	-0.213***	-0.257***	0.087	0.121***	0.073***
N	19203	9616	10045	6003	15405
N_{groups}	2229	1227	1372	728	1536
σ	1.328	1.375	1.436	0.996	0.825
σ_u	0.662	0.795	0.807	0.397	0.419
σ_e	1.151	1.122	1.187	0.914	0.710
ρ	0.249	0.334	0.316	0.159	0.259
R^2_{within}	0.313	0.313	0.355	0.530	0.574
$R^2_{overall}$	0.747	0.775	0.725	0.885	0.885
$R^2_{between}$	0.839	0.844	0.801	0.945	0.927
χ^2	12286.686	6273.990	7064.170	14214.656	28984.406
Root MSE	1.220	1.204	1.259	0.938	0.717

Fixed effects models

	Rice	Wheat	Maize	Bananas	Coffee
ln *c*	-0.720***	-0.892***	-0.656***	-0.194***	-0.117***
ln p^{FOB}	-0.888***	-0.537***	-0.814***	-0.194*	-0.217***
ln *b*	0.483***	0.527***	0.505***	0.809***	0.814***
ln *c* × *dummy* s^{+}	-0.146***	0.105	-0.032	-0.069	-0.163***
ln p^{FOB} × *dummy* s^{+}	-0.279***	-0.519***	-0.229***	-0.026	-0.362***
ln *b* × *dummy* s^{+}	-0.196***	-0.258***	-0.226***	-0.221***	-0.218***
ln $prod^{Orig}$	0.149*	0.646***	0.390***	0.085	0.171***
ln $yield^{Orig}$	-0.489***	-0.480**	-0.331*	0.141	0.040
N	19203	9616	10045	6003	15405
N_{groups}	2229	1227	1372	728	1536
σ	1.892	2.228	2.098	1.315	1.022
σ_u	1.501	1.925	1.730	0.946	0.734
σ_e	1.151	1.122	1.187	0.914	0.710
ρ	0.630	0.747	0.680	0.518	0.517
R^2_{within}	0.322	0.334	0.370	0.534	0.577
$R^2_{overall}$	0.683	0.628	0.611	0.878	0.876
$R^2_{between}$	0.767	0.622	0.643	0.935	0.912
Root MSE	1.082	1.048	1.103	0.856	0.674
F	345.416	153.056	232.000	242.829	907.881
corr(u_i,X_b)	0.540	0.228	0.182	0.715	0.586

Legend
* p<.05; ** p<.01; *** p<.001, standard errors are clustered within each importer-exporter pair.

Annex Table 4: Models IV RE, IV FE (random effects, fixed effects)

Random effects models

	Rice	Wheat	Maize	Bananas	Coffee
ln *c*	-0.803***	-0.647***	-0.724***	-0.120*	-0.146**
ln p^{FOB}	-1.248***	-0.582**	-0.826***	-0.299**	-0.310***
ln *b*	0.569***	0.640***	0.590***	0.943***	0.904***
ln *c* × *dummy* s^+	-0.194***	0.065	-0.079*	-0.091	-0.169***
ln p^{FOB} × *dummy* s^+	-0.350***	-0.705***	-0.275***	-0.059	-0.413***
ln *b* × *dummy* s^+	-0.221***	-0.307***	-0.257***	-0.242***	-0.228***
ln *c* × ln GDP^{Dest}	0.044	-0.047	0.057*	-0.009	0.009
ln p^{FOB} × ln GDP^{Dest}	0.167***	0.031	0.078*	0.020	0.101***
ln *b* × ln GDP^{Dest}	0.048***	0.047***	0.037***	0.012***	0.005
ln $prod^{Orig}$	0.065***	0.208***	0.144***	0.032**	0.115***
ln $yield^{Orig}$	-0.158***	-0.167**	0.207***	0.120**	0.077***
N	19085	9599	10020	5979	15369
N_{groups}	2205	1221	1364	720	1528
σ	1.317	1.373	1.430	0.994	0.824
σ_u	0.660	0.799	0.802	0.398	0.422
σ_e	1.140	1.117	1.184	0.910	0.708
ρ	0.251	0.338	0.314	0.160	0.262
R^2_{within}	0.327	0.319	0.360	0.533	0.575
$R^2_{overall}$	0.753	0.783	0.736	0.885	0.885
$R^2_{between}$	0.833	0.842	0.803	0.945	0.927
χ^2	14718.377	7428.153	7528.722	14861.497	29503.687
Root MSE	1.201	1.190	1.246	0.936	0.716

Fixed effects models

	Rice	Wheat	Maize	Bananas	Coffee
ln *c*	-0.755***	-0.562**	-0.766***	-0.192	-0.088
ln p^{FOB}	-1.201***	-0.642*	-1.119***	-0.723***	-0.535***
ln *b*	0.368***	0.450***	0.457***	0.731***	0.750***
ln *c* × *dummy* s^+	-0.155***	0.093	-0.042	-0.067	-0.167***
ln p^{FOB} × *dummy* s^+	-0.298***	-0.531***	-0.230***	-0.008	-0.365***
ln *b* × *dummy* s^+	-0.201***	-0.258***	-0.227***	-0.221***	-0.218***
ln *c* × ln GDP^{Dest}	0.019	-0.118*	0.051	-0.003	-0.003
ln p^{FOB} × ln GDP^{Dest}	0.124**	0.054	0.137**	0.161*	0.115*
ln *b* × ln GDP^{Dest}	0.063***	0.032***	0.024**	0.027**	0.022***
ln $prod^{Orig}$	0.122*	0.646***	0.403***	0.141*	0.174***
ln $yield^{Orig}$	-0.374***	-0.402*	-0.250	0.205*	0.034
N	19085	9599	10020	5979	15369
N_{groups}	2205	1221	1364	720	1528
σ	1.831	2.198	2.071	1.340	1.062
σ_u	1.433	1.893	1.700	0.984	0.792
σ_e	1.140	1.117	1.184	0.910	0.708
ρ	0.613	0.742	0.673	0.539	0.556
R^2_{within}	0.337	0.338	0.374	0.538	0.580
$R^2_{overall}$	0.696	0.644	0.623	0.861	0.867
$R^2_{between}$	0.759	0.634	0.652	0.908	0.893
Root MSE	1.072	1.044	1.100	0.854	0.672
F	273.390	117.658	172.566	207.674	733.612
corr(u_i,X_b)	0.477	0.225	0.154	0.556	0.537

Legend

* p<.05; ** p<.01; *** p<.001, standard errors are clustered within each importer-exporter pair.

Annex Table 5: Models V Regional Interactions

	Interactions									Controls	
	EAS	ECS	LCN	MEA	NAC	SAS	SSF	*dummy* s^+	GDP^{Dest}		
Rice											
ln c	-0.762***	-0.925***	-0.739***	-0.677***	-0.691***	-0.288	-0.909***	-0.188***	0.052	ln $prod^{Orig}$	0.069***
ln p^{FOB}	-1.310***	-1.413***	-0.982***	-1.336***	-1.282***	-0.600	-1.431***	-0.337***	0.196***	ln $yield^{Orig}$	-0.162***
ln b	0.534***	0.489***	0.505***	0.548***	0.572***	0.593***	0.605***	-0.221***	0.063***		
Wheat											
ln c	-0.423	-0.549**	-1.202***	-0.886***	-0.223	-0.140	-0.596*	0.060	-0.077	ln $prod^{Orig}$	0.220***
ln p^{FOB}	-0.556	-0.748*	-1.407***	-0.663*	-0.818	0.367	-0.397	-0.699***	0.098	ln $yield^{Orig}$	-0.188***
ln b	0.696***	0.644***	0.604***	0.639***	0.733***	0.562***	0.622***	-0.305***	0.042***		
Maize											
ln c	-1.006***	-0.679***	-0.647***	-1.373***	-0.618***	-0.378	-0.745***	-0.079*	0.057	ln $prod^{Orig}$	0.143***
ln p^{FOB}	-1.261***	-0.766***	-0.936***	-1.582***	-0.586*	-0.417	-0.539***	-0.269***	0.090	ln $yield^{Orig}$	0.171**
ln b	0.568***	0.585***	0.556***	0.567***	0.707***	0.622***	0.617***	-0.254***	0.036***		
Bananas											
ln c	-0.199	-0.205*	-0.053	-0.350**	-0.247	-0.044	-0.194*	-0.099	0.017	ln $prod^{Orig}$	0.034**
ln p^{FOB}	-0.486**	-0.338*	-0.031	-0.705**	-0.259	-0.005	-0.628	-0.069	0.034	ln $yield^{Orig}$	0.103**
ln b	0.945***	0.916***	0.956***	0.919***	0.938***	0.863***	0.960***	-0.242***	0.018***		
Coffee											
ln c	-0.179**	-0.146*	-0.148	-0.098	-0.261*	0.178	-0.300**	-0.170***	0.012	ln $prod^{Orig}$	0.117***
ln p^{FOB}	-0.437**	-0.449***	-0.264	-0.252*	-0.498**	-0.906	0.131	-0.414***	0.138***	ln $yield^{Orig}$	0.072***
ln b	0.904***	0.913***	0.870***	0.925***	0.880***	0.987***	0.858***	-0.229***	0.004		

Regression statistics – Random Effects

	N	N_{groups}	σ	σ_u	σ_e	ρ	R^2_{within}	$R^2_{overall}$	$R^2_{between}$	Root MSE	F
Rice	19085	2205	1.315	0.658	1.138	0.251	0.328	0.756	0.836	1.195	
Wheat	9599	1221	1.366	0.791	1.114	0.335	0.322	0.783	0.837	1.187	
Maize	10020	1364	1.420	0.795	1.176	0.314	0.367	0.739	0.804	1.238	
Bananas	5979	720	0.986	0.391	0.905	0.157	0.536	0.886	0.944	0.935	
Coffee	15369	1528	0.819	0.417	0.705	0.259	0.577	0.886	0.927	0.716	

Legend

* p<.05; ** p<.01; *** p<.001, standard errors are clustered within each importer-exporter pair.

EAS	East Asia & Pacific
ECS	Europe & Central Asia
LCN	Latin America & Caribbean
MEA	Middle East & North Africa
NAC	North America
SAS	South Asia
SSF	Sub-Saharan Africa

	Interactions									Controls	
	EAS	ECS	LCN	MEA	NAC	SAS	SSF	*dummy s*$^{+}$	GDP^{Dest}		
Rice											
ln *c*	-0.687***	-0.765***	-0.630***	-0.647***	-0.462*	-0.399	-0.847***	-0.147***	-0.001	ln *prod*^{Orig}	0.125*
ln p^{FOB}	-1.363***	-1.471***	-0.849**	-1.161***	-1.176***	-0.990	-1.250***	-0.294***	0.170*	ln *yield*^{Orig}	-0.355***
ln *b*	0.379***	0.325***	0.312***	0.312***	0.302***	0.433***	0.392***	-0.201***	0.076***		
Wheat											
ln *c*	-0.377	-0.477*	-1.122***	-0.813*	0.081	0.188	-0.314	0.091	-0.145	ln *prod*^{Orig}	0.662***
ln p^{FOB}	-1.020	-0.679	-1.444***	-1.269***	-0.908	-3.409	0.091	-0.533***	0.118	ln *yield*^{Orig}	-0.395*
ln *b*	0.460***	0.426***	0.423***	0.542***	0.575***	0.403**	0.439***	-0.257***	0.036**		
Maize											
ln *c*	-1.185***	-0.700***	-0.609***	-1.267***	-0.647***	-0.550**	-0.749***	-0.037	0.042	ln *prod*^{Orig}	0.393***
ln p^{FOB}	-1.847***	-0.934***	-0.970***	-1.540***	-0.867**	-0.916*	-0.942***	-0.217***	0.106	ln *yield*^{Orig}	-0.247
ln *b*	0.469***	0.454***	0.489***	0.387***	0.701***	0.525***	0.429***	-0.226***	0.022*		
Bananas											
ln *c*	-0.351	-0.366**	0.064	-0.275	-0.240	-0.386	-0.058	-0.079	0.039	ln *prod*^{Orig}	0.136*
ln p^{FOB}	-0.973***	-0.661*	-0.177	-1.162**	-0.482	-0.916	-0.670*	-0.022	0.168*	ln *yield*^{Orig}	0.181
ln *b*	0.862***	0.674***	0.764***	0.615***	0.782***	0.642*	0.641***	-0.222***	0.036***		
Coffee											
ln *c*	0.020	-0.057	-0.054	0.169	-0.438***	-0.481	-0.150	-0.174***	-0.013	ln *prod*^{Orig}	0.171***
ln p^{FOB}	-0.586*	-0.728***	-0.294	-0.220	-1.122***	-1.593*	0.074	-0.367***	0.166**	ln *yield*^{Orig}	0.041
ln *b*	0.755***	0.782***	0.654***	0.705***	0.747***	0.843***	0.590***	-0.220***	0.017*		

Regression statistics – Fixed Effects

	N	N_{groups}	σ	σ_u	σ_e	ρ	R^2_{within}	$R^2_{overall}$	$R^2_{between}$	Root MSE	F
Rice	19085	2205	1.829	1.432	1.138	0.613	0.339	0.695	0.756	1.070	114.744
Wheat	9599	1221	2.221	1.922	1.114	0.748	0.343	0.64	0.619	1.041	51.237
Maize	10020	1364	2.069	1.703	1.176	0.677	0.383	0.627	0.646	1.093	72.981
Bananas	5979	720	1.436	1.115	0.905	0.603	0.545	0.837	0.859	0.849	90.170
Coffee	15369	1528	1.192	0.961	0.705	0.650	0.584	0.817	0.818	0.669	331.172

Legend

* p<.05; ** p<.01; *** p<.001, standard errors are clustered within each importer-exporter pair.

EAS	East Asia & Pacific
ECS	Europe & Central Asia
LCN	Latin America & Caribbean
MEA	Middle East & North Africa
NAC	North America
SAS	South Asia
SSF	Sub-Saharan Africa

Annex Table 6: Models II FE, III FE, IV FE; Prices, base shares, interactions for income country groups – Rice

	Model II FE			**Model III FE**			**Model IV FE**		
Variable	**All**	**HIC**	**ex HIC**	**All**	**HIC**	**ex HIC**	**All**	**HIC**	**ex HIC**
ln c	-0.785***	-0.701***	-0.866***	-0.720***	-0.602***	-0.803***	-0.755***	-1.000**	-0.683***
ln p^{FOB}	-1.052***	-0.874***	-1.315***	-0.888***	-0.657***	-1.221***	-1.201***	-2.656***	-1.109***
ln b	0.347***	0.419***	0.295***	0.483***	0.559***	0.440***	0.368***	0.366***	0.381***
ln $c \times$ *dummy* s^{+}				-0.146***	-0.241***	-0.133	-0.155***	-0.250***	-0.113
ln $p^{FOB} \times$ *dummy* s^{+}				-0.279***	-0.416***	-0.074	-0.298***	-0.432***	-0.072
ln $b \times$ *dummy* s^{+}				-0.196***	-0.182***	-0.225***	-0.201***	-0.184***	-0.227***
ln $c \times$ ln GDP^{Dest}							0.019	0.116	-0.131*
ln $p^{FOB} \times$ ln GDP^{Dest}							0.124**	0.566***	-0.129
ln $b \times$ ln GDP^{Dest}							0.063***	0.058*	0.068***
ln $prod^{Orig}$	0.218***	0.205***	0.206	0.149*	0.119*	0.148	0.122*	0.127**	0.106
ln $yield^{Orig}$	-0.445***	-0.262*	-0.657***	-0.489***	-0.300**	-0.710***	-0.374***	-0.235*	-0.536**
Fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	19203	10314	8889	19203	10314	8889	19085	10254	8831
N_{groups}	2229	964	1265	2229	964	1265	2205	953	1252
σ	2.106	1.877	2.246	1.892	1.619	2.049	1.831	1.585	2.056
σ_u	1.698	1.554	1.725	1.501	1.310	1.553	1.433	1.269	1.569
σ_e	1.246	1.054	1.438	1.151	0.952	1.337	1.140	0.950	1.328
ρ	0.650	0.685	0.590	0.630	0.655	0.574	0.613	0.641	0.583
R^2_{within}	0.205	0.265	0.172	0.322	0.401	0.284	0.337	0.406	0.294
$R^2_{overall}$	0.597	0.709	0.502	0.683	0.792	0.588	0.696	0.794	0.580
$R^2_{between}$	0.687	0.786	0.600	0.767	0.862	0.678	0.759	0.859	0.661
Root MSE	1.171	1.003	1.331	1.082	0.906	1.238	1.072	0.904	1.231
F	275.690	202.360	119.399	345.416	217.472	174.486	273.390	162.586	131.560
corr(u_i,X_b)	0.469	0.597	0.337	0.540	0.678	0.387	0.477	0.658	0.356

legend:

* p<.05; ** p<.01; *** p<.001, standard errors are clustered within each importer-exporter pair.

All - All importing countries; HIC - High income importing countries; ex HIC - Middle and low income importing countries

Annex Table 7: Models II FE, III FE, IV FE; Prices, base shares, GDP interactions – Wheat

	Model II FE			Model III FE			Model IV FE		
Variable	**All**	**HIC**	**ex HIC**	**All**	**HIC**	**ex HIC**	**All**	**HIC**	**ex HIC**
ln *c*	-0.995***	-1.045***	-0.900***	-0.892***	-0.866***	-0.922***	-0.562**	0.034	-0.784***
ln p^{FOB}	-0.908***	-0.728***	-1.298***	-0.537***	-0.379*	-0.906***	-0.642*	0.030	-0.845**
ln *b*	0.227***	0.256***	0.168***	0.527***	0.561***	0.470***	0.450***	0.545***	0.433***
ln *c* × *dummy* s^+				0.105	0.027	0.076	0.093	0.031	0.103
ln p^{FOB} × *dummy* s^+				-0.519***	-0.550***	-0.515*	-0.531***	-0.539***	-0.527*
ln *b* × *dummy* s^+				-0.258***	-0.248***	-0.283***	-0.258***	-0.247***	-0.283***
ln *c* × ln GDP^{Dest}							-0.118*	-0.291**	-0.121
ln p^{FOB} × ln GDP^{Dest}							0.054	-0.150	0.009
ln *b* × ln GDP^{Dest}							0.032***	0.004	0.036*
ln $prod^{Orig}$	0.927***	0.886***	0.963**	0.646***	0.617***	0.643*	0.646***	0.581***	0.664**
ln $yield^{Orig}$	-0.616**	-0.194	-1.174***	-0.480**	-0.148	-0.918**	-0.402*	-0.163	-0.829**
Fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	9616	5882	3734	9616	5882	3734	9599	5872	3727
N_{groups}	1227	627	600	1227	627	600	1221	625	596
σ	2.803	2.725	2.752	2.228	2.086	2.263	2.198	2.066	2.248
σ_u	2.492	2.402	2.442	1.925	1.772	1.955	1.893	1.749	1.941
σ_e	1.283	1.286	1.269	1.122	1.101	1.140	1.117	1.099	1.136
ρ	0.790	0.777	0.787	0.747	0.721	0.746	0.742	0.717	0.745
R^2_{within}	0.127	0.158	0.087	0.334	0.382	0.264	0.338	0.385	0.269
$R^2_{overall}$	0.405	0.377	0.409	0.628	0.626	0.601	0.644	0.631	0.611
$R^2_{between}$	0.371	0.344	0.346	0.622	0.633	0.561	0.634	0.643	0.569
Root MSE	1.199	1.215	1.163	1.048	1.041	1.044	1.044	1.039	1.041
F	73.096	62.337	21.312	153.056	127.068	46.740	117.658	96.089	33.985
corr(u_i,X_b)	-0.041	-0.074	-0.087	0.228	0.194	0.209	0.225	0.220	0.184

legend:
* p<.05; ** p<.01; *** p<.001, standard errors are clustered within each importer-exporter pair.
All - All importing countries; HIC - High income importing countries; ex HIC - Middle and low income importing countries

Annex Table 8: Models II FE, III FE, IV FE; Prices, base shares, GDP interactions – Maize

	Model II FE			**Model III FE**			**Model IV FE**		
Variable	**All**	**HIC**	**ex HIC**	**All**	**HIC**	**ex HIC**	**All**	**HIC**	**ex HIC**
ln *c*	-0.698***	-0.671***	-0.745***	-0.656***	-0.589***	-0.708***	-0.766***	-0.370	-0.796***
ln p^{FOB}	-1.067***	-0.941***	-1.279***	-0.814***	-0.631***	-1.106***	-1.119***	-0.861*	-1.135***
ln *b*	0.267***	0.296***	0.234***	0.505***	0.534***	0.489***	0.457***	0.499***	0.481***
ln *c* × *dummy* s^{+}				-0.032	-0.081*	-0.089	-0.042	-0.082*	-0.097
ln p^{FOB} × *dummy* s^{+}				-0.229***	-0.280***	-0.165	-0.230***	-0.278***	-0.173
ln *b* × *dummy* s^{+}				-0.226***	-0.213***	-0.259***	-0.227***	-0.213***	-0.260***
ln *c* × ln GDP^{Dest}							0.051	-0.070	0.110
ln p^{FOB} × ln GDP^{Dest}							0.137**	0.072	0.039
ln *b* × ln GDP^{Dest}							0.024**	0.011	0.011
ln $prod^{Orig}$	0.470***	0.494***	0.299	0.390***	0.373***	0.329*	0.403***	0.385***	0.336*
ln $yield^{Orig}$	-0.442**	-0.381	-0.383	-0.331*	-0.189	-0.453	-0.250	-0.176	-0.453
Fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	10045	5887	4158	10045	5887	4158	10020	5875	4145
N_{groups}	1372	687	685	1372	687	685	1364	685	679
σ	2.483	2.468	2.406	2.098	1.987	2.146	2.071	1.983	2.144
σ_u	2.081	2.118	1.906	1.730	1.659	1.709	1.700	1.654	1.708
σ_e	1.353	1.267	1.468	1.187	1.094	1.298	1.184	1.094	1.296
ρ	0.703	0.737	0.628	0.680	0.697	0.634	0.673	0.696	0.634
R^2_{within}	0.181	0.209	0.154	0.370	0.410	0.340	0.374	0.411	0.342
$R^2_{overall}$	0.445	0.436	0.468	0.611	0.646	0.586	0.623	0.644	0.587
$R^2_{between}$	0.473	0.501	0.482	0.643	0.713	0.580	0.652	0.709	0.580
Root MSE	1.257	1.191	1.342	1.103	1.029	1.186	1.100	1.029	1.185
F	102.364	63.992	44.697	232.000	159.721	90.527	172.566	115.961	68.036
corr(u_i,X_b)	0.059	0.023	0.232	0.182	0.234	0.175	0.154	0.216	0.170

legend:
* p<.05; ** p<.01; *** p<.001, standard errors are clustered within each importer-exporter pair.
All - All importing countries; HIC - High income importing countries; ex HIC - Middle and low income importing countries

Annex Table 9: Models II FE, III FE, IV FE; Prices, base shares, GDP interactions – Bananas

	Model II FE			Model III FE			Model IV FE		
Variable	**All**	**HIC**	**ex HIC**	**All**	**HIC**	**ex HIC**	**All**	**HIC**	**ex HIC**
ln *c*	-0.205***	-0.249***	-0.090	-0.194***	-0.222***	-0.096	-0.192	-0.490*	-0.137
ln p^{FOB}	-0.188	-0.108	-0.568**	-0.194*	-0.135	-0.449*	-0.723***	-1.051*	-0.817**
ln *b*	0.553***	0.565***	0.509***	0.809***	0.840***	0.719***	0.731***	0.733***	0.689***
ln *c* × *dummy* s^+				-0.069	-0.120	-0.006	-0.067	-0.127*	-0.004
ln p^{FOB} × *dummy* s^+				-0.026	-0.126	0.136	-0.008	-0.121	0.159
ln *b* × *dummy* s^+				-0.221***	-0.232***	-0.198***	-0.221***	-0.233***	-0.197***
ln *c* × ln GDP^{Dest}							-0.003	0.086	0.018
ln p^{FOB} × ln GDP^{Dest}							0.161*	0.267*	0.245
ln *b* × ln GDP^{Dest}							0.027**	0.032*	0.027
ln $prod^{Orig}$	0.101	0.053	0.474	0.085	0.021	0.519*	0.141*	0.067	0.628**
ln $yield^{Orig}$	0.132	0.107	0.172	0.141	0.139	0.111	0.205*	0.180	0.292
Fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	6003	4559	1444	6003	4559	1444	5979	4557	1422
N_{groups}	728	490	238	728	490	238	720	490	230
σ	1.757	1.781	2.043	1.315	1.286	1.825	1.340	1.278	1.981
σ_u	1.362	1.402	1.694	0.946	0.936	1.527	0.984	0.927	1.711
σ_e	1.110	1.098	1.143	0.914	0.882	1.000	0.910	0.880	0.997
ρ	0.601	0.620	0.687	0.518	0.529	0.700	0.539	0.526	0.746
R^2_{within}	0.311	0.321	0.293	0.534	0.562	0.461	0.538	0.564	0.468
$R^2_{overall}$	0.813	0.825	0.630	0.878	0.890	0.709	0.861	0.887	0.670
$R^2_{between}$	0.904	0.916	0.593	0.935	0.943	0.672	0.908	0.935	0.618
Root MSE	1.041	1.037	1.044	0.856	0.834	0.913	0.854	0.832	0.913
F	163.061	127.569	41.148	242.829	230.098	46.630	207.674	191.836	42.490
corr(u_i,X_b)	0.785	0.818	0.098	0.715	0.747	-0.057	0.556	0.690	-0.244

legend:
* p<.05; ** p<.01; *** p<.001, standard errors are clustered within each importer-exporter pair.
All - All importing countries; HIC - High income importing countries; ex HIC - Middle and low income importing countries

Annex Table 10: Models II FE, III FE, IV FE; Prices, base shares, GDP interactions – Coffee

	Model II FE			**Model III FE**			**Model IV FE**		
Variable	**All**	**HIC**	**ex HIC**	**All**	**HIC**	**ex HIC**	**All**	**HIC**	**ex HIC**
ln *c*	-0.117**	-0.141***	-0.033	-0.117***	-0.121***	-0.080	-0.088	0.180*	-0.124
ln p^{FOB}	-0.417***	-0.412***	-0.484***	-0.217***	-0.230***	-0.189	-0.535***	-0.730***	-0.303
ln *b*	0.535***	0.568***	0.432***	0.814***	0.853***	0.695***	0.750***	0.807***	0.697***
ln *c* × *dummy* s^+				-0.163***	-0.198***	-0.076	-0.167***	-0.197***	-0.079
ln p^{FOB} × *dummy* s^+				-0.362***	-0.345***	-0.416***	-0.365***	-0.350***	-0.410***
ln *b* × *dummy* s^+				-0.218***	-0.229***	-0.187***	-0.218***	-0.227***	-0.188***
ln *c* × ln GDP^{Dest}							-0.003	-0.086***	0.031
ln p^{FOB} × ln GDP^{Dest}							0.115*	0.163*	0.108
ln *b* × ln GDP^{Dest}							0.022***	0.009	-0.002
ln $prod^{Orig}$	0.268***	0.268***	0.159	0.171***	0.171***	0.075	0.174***	0.188***	0.063
ln $yield^{Orig}$	0.070	0.072	0.071	0.040	0.014	0.169	0.034	0.014	0.189
Fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	15405	11961	3444	15405	11961	3444	15369	11944	3425
N_{groups}	1536	1022	514	1536	1022	514	1528	1019	509
σ	1.348	1.220	1.652	1.022	0.907	1.317	1.062	0.924	1.327
σ_u	1.009	0.867	1.313	0.734	0.613	1.016	0.792	0.642	1.030
σ_e	0.893	0.859	1.002	0.710	0.668	0.838	0.708	0.664	0.838
ρ	0.561	0.505	0.632	0.517	0.458	0.595	0.556	0.483	0.602
R^2_{within}	0.330	0.368	0.218	0.577	0.618	0.454	0.580	0.622	0.456
$R^2_{overall}$	0.784	0.799	0.757	0.876	0.887	0.842	0.867	0.883	0.841
$R^2_{between}$	0.848	0.874	0.837	0.912	0.931	0.880	0.893	0.922	0.880
Root MSE	0.848	0.821	0.925	0.674	0.639	0.773	0.672	0.635	0.773
F	336.350	321.873	47.931	907.881	987.631	117.226	733.612	764.962	86.162
corr(u_i,X_b)	0.615	0.587	0.764	0.586	0.520	0.749	0.537	0.496	0.750

legend:
* p<.05; ** p<.01; *** p<.001, standard errors are clustered within each importer-exporter pair.
All - All importing countries; HIC - High income importing countries; ex HIC - Middle and low income importing countries